OVERCOMING BARRIERS TO ITS--
LESSONS FROM OTHER TECHNOLOGIES

FINAL TASK C REPORT

MODELS OF PUBLIC AND PRIVATE PARTICIPATION IN ATMS/ATIS

Prepared for the Federal Highway Administration

by The Urban Institute
with
Cambridge Systematics, Inc.
Miller, Canfield, Paddock and Stone
MTA/EMCI

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EXECUTIVE SUMMARY

This task report concerning alternative models of public and private sector involvement is the third in a series comprising the overall study, ***Overcoming Barriers to ITS -- Lessons from Other Technologies:*** This report examines different ways the public and private sector can organize to deploy Advanced Traffic Management Systems (ATMS) and Advanced Traveler Information Systems (ATIS). Different approaches to public and private participation in these advanced transportation systems can be classified according to whether they pertain to pre-deployment or deployment. Pre-deployment consists of the technology development, planning, operational testing, and design of a system architecture. Deployment consists of designing, building (construction, manufacturing, installation), operation and maintenance of systems in specific locales or regions. These phases are not entirely distinct. Some elements of ATMS and ATIS have already been deployed in many regions and other elements will be deployed in some places before a national system architecture has been adopted.

The following are the main conclusions and corresponding recommendations of this task report.

Political, institutional and practical reasons suggest different levels of government and the private sector will work together to deploy ATMS and ATIS in a myriad of different ways. Possible forms of public/private participation in pre-deployment and deployment activities are listed below.

Pre-deployment

1. ***Program/system manager.*** A private contractor, but possibly a public agency, responsible for pre-deployment activities concerning a system.

2. ***Cost sharing.*** Legal agreements, cooperative agreements or memorandums of understanding that set out cost sharing responsibilities for the public and private sector for pre-deployment activities.

3. ***Partnering.*** Any of various cooperative arrangements between the public and private sector in the furtherance of pre-deployment goals.

4. ***Cooperative research and development agreements.*** Modeled after agreements between national laboratories and private industry that provide incentives for private participation in research and development through the sharing of rights to intellectual property that results from the research.

5. ***Design-build-operate.*** An approach to design and deployment that gives responsibility for designing, building and perhaps in addition operation and maintenance to a single organization, usually a private contractor.

Deployment

1. ***Pure public provision.*** A public agency owns, designs, builds, operates and maintains the system.

2. ***Public owner-builder.*** Similar to pure public provision, but the public agency may contract with the private sector to operate and maintain the system.

3. ***Standard low-bid contracting.*** Competitive procurement involving bids based on the lowest first cost and normally involving method specifications as opposed to performance specifications.

4. ***Lifecycie contracting.*** Competitive procurement involving selection of the bid that has the lowest lifecycle cost or that gives considerable weight to lifecycle costs in the award of a contract.

5. ***Performance contracting.*** Competitive procurement based upon selecting a contractor that can meet performance specifications based on the lowest overall costs (preferably lifecycle costs).

6. ***Public turnkey (including Build-Transfer-Operate (BTO) and Build-Operate-Transfer (BOT)).*** A public owner that contracts for the design, building and perhaps, in addition, maintenance and operation of a system. May involve toll or private financing with limitations on the prices consumers can be charged and the rate of return on investment. May involve the sale of the constructed facility back to the owner of the right-of-way followed by leasing the facility in order to operate it. This model can also involve turning responsibility for maintenance and operation back to the public owner after the contractor earns a reasonable return on its investment.

7. ***Private owner-builder.*** A private firm owns, designs, builds, and most likely, in addition, maintains and operates the system.

8. ***Private turnkey.*** A private firm contracts with another private firm (or a public agency) to design, build, and possibly, in addition, maintain and operate the system.

9. ***Private competition.*** Provision of a system purely through private competition in the market place, and having no public involvement.

10. ***Public/private competition.*** A competitive bidding process undertaken by a government agency where the public and private sector compete with one another to provide a product, service or system.

11. ***Auction.*** The public sector sells the rights to provide a service through an auction. Bidders are generally private companies but could include public agencies alone or in partnership with private firms.

12. ***Yardstick competition.*** Using the prices charged consumers and the cost of provision by the public sector as a benchmark for determining (1) the price that a regulated firm should charge consumers and (2) the base to which the rate of return on investment is applied.

13. ***Open solicitation of public/private partnerships.*** A competitive solicitation and selection process seeking ideas for joint public/private ventures where the public agency may offer to share a portion of the costs of projects selected.

14. ***System manager.*** A public agency develops initial design and performance specifications for a system and contracts with a single organization, normally a private firm, to complete the

design of the system and then build, operate, and maintain it. The system manager can be given considerable latitude in the approach to implementation including being responsible for preparing contract bid documents for various phases of deployment.

15. ***Cost Sharing.*** Any arrangement for sharing the costs between the public and private sector. Cost sharing can be in the form of direct or indirect payments, in money or in-kind, and apply to capita1 costs, variable costs or both. Funds can be raised through any method of public or private finance.

16. ***Joint ownership.*** Any arrangement that involves the public and private sector sharing ownership. Joint ownership can include legal partnerships and for-profit or non-profit corporations.

17. ***Functional division of responsibilities.*** A cooperative arrangement among the public and private sector in which responsibilities are assigned according to functions, roles, or traditional responsibilities connected to ownership of property, equipment, software, telecommunications, etc.

18. ***Competitive joint venture.*** An innovative model applicable to a facility which exhibits decreasing average costs, possibly including ATMS and ATIS, in which there is joint ownership of facilities, but competitive provision of output. A competitive joint venture is not unlike morning and evening newspapers which jointly own a printing press but compete with each other within the same service area.

19. ***Public/private consortium under a public agency (Intermediary).*** A non-profit agency or corporation managed by a governing board composed of representatives of both the public and private sector and which can contract for services.

20. ***Incentive regulation.*** Provision of a system under a regulatory framework which includes incentives for efficient provision of services, such as penalties for pollution and rewards for increasing public benefits. Incentive regulation may involve assignment of property rights to either the producer or consumer depending upon whether positive or negative externalities are involved.

21. ***Public Franchise.*** The granting by government of a special privilege to a private party, denied as a common right to all citizens, to make use of public property (usually public streets, easements, and/or rights-of-way) to achieve public benefits and private profit. Classic examples are traditional public utility franchises for electricity, telephone, water, gas, railroads, mass transit, and cable TV. Franchises typically have monopoly power and are regulated.

22. ***Business franchise.*** A way for a franchise owner to earn money and replicate a business format in many different locations by requiring a franchisee to make an initial minimum investment, use a trademark or logo, furnish the product or service in conformance with a marketing plan, and the payment of a royalty or fee.

23. ***License.*** The right or permission granted by government to carry on a business or engage in a certain activity that would be illegal without the license. A license is not a contract and

usually does not convey to the licensee the right to occupy public property (e.g. liquor or drivers license). Note that the Communications Act of 1934 states that no Federal Communications licensee shall have a property interest in its license or the radio frequency spectrum it uses.

24. ***Concession.*** A grant or lease by a private or public entity of a portion of premises for some use, or of the right to enter upon such premises, usually for purposes of commercial gain to the concessionaire and perhaps in addition the grantor. A concession usually does not have a public interest component, but if it does, it becomes virtually indistinguishable from a franchise.

25. Leasing. The sale or franchising of the right to use a piece of. property. Leasing strategies include Lease-Develop-Operate and Develop-Lease-Operate. Leasing can thus provide access to and use of public and private property necessary for one or more phases of deployment.

26. Private provision and revenue sharing under government agencis. The public sector grants the private sector the right to provide a service on an exclusive or non-exclusive basis as an extension of government and under the government banner in return for provision of the service and a share of the revenues.

27. Monopoly Regulation. Regulation of a investor-owned monopoly, usually a franchise, by a public utility commission or similar agency. Regulation typically focuses on the rates charged consumers and the rate-of-return on investment.

The applicability of various models listed above to ATMS and ATIS should be based upon a broad set of criteria, namely public and private sector involvement at various stages over the lifecycle, a variety of economic issues (barriers to entry and exit, presence of economies of scale, monopoly versus competition, costs and risks, impact on consumer prices, public and private benefits), adaptability to ATMS/ATIS, and speed of deployment. Table E-I provides a summary evaluation of each model with respect to these issues. These models are not necessarily mutually exclusive and can be mixed and matched in various ways. Table E-2 shows which models have at least some small degree of compatibility with one another.

Recommendations:

- The models most conducive to ATMS deployment and which FHWA and the ITS community should evaluate further are the following:

  - Lifecycle contracting
  - Performancecontracting
  - Public turnkey (including BOT and BTO)
  - Auctions
  - Open solicitation of public/private partnerships
  - System manager
  - Cost sharing
  - Joint ownership
  - Functional division of responsibilities
  - Competitive joint venture

TABLE E-1: MODELS OF PUBLIC/PRIVATE PARTICIPATION

ORGANIZATIONAL MODEL	INVOLVEMENT AT STAGES OF LIFE-CYCLE						ECONOMIC ISSUES							ADAPTABILITY		SPEED OF DEPLOYMENT & MARKET PENETRATION	
	Initial Ownership	Design	Build	Operate	Maintain	Final Ownership	Entry	Exit	Economies of Scale	Competition vs Monopoly	Costs & Risks	Consumer Price	Benefits	ATMS	ATIS	ATMS	ATIS
1. Pure Public Provider	Pu	Pu	Pu	Pu	Pu	Pu	R	B		GM	NR,IA	FL	PB	L	L	L	L
2. Public Owner-Builder	Pu	Pu	Pu	Pu,Pr,OPu	Pu,Pr,OPu	Pu,Pr,OPu				GM,CS	NR,LC,IA	FL	PB,PM	L	L	L	L
3. Standard Low Bid Contracting	Pu	Pu,Pr	Pr	Pu,Pr	Pu,Pr	Pu				CC,CS	NR,IA	FL	PB,PM	L-M	L-M	L-M	L-M
4. Lifecycle Contracting	Pu	Pu,Pr	Pr	Pu,Pr	Pu,Pr	Pu				CC,CS	NR,IA	FL	PB,PM	M-H	M-H	M-H	M-H
5. Performance Contracting	Pu	Pu,Pr	Pr	Pu,Pr	Pu,Pr	Pu				CC,CS	NR,IA	FL	PB,PM	M-H	M-H	M-H	M-H
6. Public Turnkey	Pu	Pr, OPu	Pr, OPu	Pu,Pr,OPu	Pu,Pr,OPu	Pu,Pr,OPu				CC,CS	CR,LC	CP	PB,PM	H	M-H	H	H
7. Private Owner-Builder	Pr	Pr	Pr	Pr,Pu,OPr	Pr,Pu,OPr	Pr,Pu,OPr				CC,CS	CR,LC	CP	PM	L	M-H	L	M-H
8. Private Turnkey	Pr	OPr,Pu	OPr,Pu	OPr,Pu	OPr,Pu	Pr,OPr,Pu				CC,CS	CR.LC.RP	CP	PM	L	M-H	L	M-H
9. Private Competition	Pr	Pr	Pr	Pr	Pr	Pr				CC,CS	CR,LC	CP	PM	L	H	L-M	L-H
10. Public/Private Competition	Pu	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr				CC,CS	NR,TC	CP	PB,PM	L	H	L-M	L-H
11. Auctions	Pu	Pr	Pr	Pr	Pr	Pu,Pr	R	B		MP,CC,CS			PM,RS,PB	L-H	L-H	M-H	M-H
12. Yardstick Competition (b)	Pr	Pr	Pr	Pr	Pr	Pr	R	B	J	MP	CR,TC	PR	RG,PB,PM	L	L	L	L
13. Open Solicitation	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr				CC,CS	CR,RR,TC,LC		PM,RS,PB	L-H	L-H	L-H	L-H
14. System Manager	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	R			MP,CC,CS	CR,LC			H	H	M-H	M-H
15. Cost Sharing	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr				AT	CR,RR		PM,PB	H	H	L-H	L-H

Organizational Model
(a) = can be exclusive or non-exclusive
(b) = can be publicly-owned ROW and investor-owned company

Involvement at Stages of Lifecycle
Pu = Public
Pr = Private
OPu = Other Public
OPr = Other Private

Entry
R = Restricted

Exit
B = Barriers

Economies of Scale
J = Justification for Model

Competition vs. Monopoly
GM = Public Monopoly
MP = Monopoly Power
CC = Competition in Construction possible
CS = Competition in Service provision possible
AT = Antitrust can be an issue

Costs and Risks
NR = No cost Recovery if service Pure Public Good
CR = Cost Recovery built-in or can be added
IA = Information Assymetries (i.e. public sector lacks private sector market knowledge)
LC = Lifecycle Cost easily internalized
TC = Transaction Costs high
RR = Risk Reduction for the public and/or private sector
IE = Internalizes Externalities (positive and negative)

Consumer Prices
FL = Free or Low
CP = Competitive Price
PR = Price Regulation

Benefits
PM = Profitable Markets
PB = Public Benefits
RS = Revenue Source can be built in (e g toll collection)
RG = Rate-of-return Regulation

Adaptability and Speed of Deployment
L = Low
M = Medium
H = High

TABLE E-1: MODELS OF PUBLIC/PRIVATE PARTICIPATION (Cont.)

ORGANIZATIONAL MODEL	INVOLVEMENT AT STAGES OF LIFE-CYCLE						ECONOMIC ISSUES							ADAPTABILITY		SPEED OF DEPLOYMENT & MARKET PENETRATION	
	Initial Ownership	Design	Build	Operate	Maintain	Final Ownership	Entry	Exit	Economies of Scale	Competition vs Monopoly	Costs & Risks	Consumer Price	Benefits	ATMS	ATIS	ATMS	ATIS
16. Joint Ownership	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr				AT,MP	CR,RR		PM,PB	L	H	L-M	M-H
17. Funct. Division of Responsibility	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr				AT	CR,RR		PM,PB	L-H	L-H	L-H	L-H
18. Competitive Joint Venture	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr			J	AT,MP	CR,RR,LC,TC	CP	RS,PM,PB	L-H	L-H	L-H	L-H
19. Pub/Priv. Consortium Under Public Agency	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	R	B		AT,MP	CR,RR,LC,TC	PR,CP	RS,RG,PM,PB	M-H	M-H	M-H	M-H
20. Incentive Regulation	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr					TC,IE		PB	L	L	L	L
21. Public Franchise (a), (b)	Pu,Pr	Pu,Pr	Pr	Pr	Pr	Pu,OPu,Pr,Opr	R	B	J	MP,CC,CS	CR,RR,LC	PR	RS,RG,PM,PB	H	L-H	H	L-H
22. Business Franchise	Pr	Pr	Pr	Pr	Pr	Pr	R	B		CC,CS	CR,RR,LC	CP	PM	L	H	L-M	H
23. License (a)	Pu	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	R	B		MP,CC,CS	CR,RR	PR,CP	PM,PB	L-M	L	L-M	L-M
24. Concession (a), (b)	Pu	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,OPu,Pr,OPr	R	B	J	MP,CC,CS	CR,RR,LC	PR	RS,RG,PM,PB	H	L-H	H	L-H
25. Leasing	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	R	B		MP	CR	PR,CP	PB,PM	L-H	L-H	L-H	L-H
26. Government Aegis (a), (b)	Pu	Pu,Pr	Pu,Pr	Pr	Pu,Pr	Pu	R	B		MP,CC,CS	CR,RR	RR,CP	RS,RG,PM,PB	L-M	M-H	L	M-H
27. Monopoly Regulation (a), (b)	Pu,Pr	Pu,Pr	Pr	Pr	Pr	Pu,OPu,Pr,OPr	R	B	J	MP,CC,CS	CR	PR	RS,RG,PM,PB	L-M	L	L-M	L

Organizational Model
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RG = Rate-of-return Regulation

Adaptability and Speed of Deployment
L = Low
M = Medium
H = High

Table E-2: Compatibility of Different Models of Public/Private Participation

	Pre-Deployment 1 Prog/System Manager	2 Cost Sharing	3 Partnering	4 CRDAs	5 Design/Build/Op	**Deployment** 1 Pure Pub Prov	2 Pub Owner-Builder	3 Std Low-Bid	4 Lifecycle Contracting	5 Perfor Contracting	6 Pub Turnkey	7 Priv Owner-Builder	8 Priv Turnkey	9 Priv Competition	10 Pub/Priv Competition	11 Auctions	12 Yardstick Comp	13 Open Solicitation	14 System Manager	15 Cost Sharing	16 Jt Ownership	17 Funct Div Resp	18 Comp Jt Vent	19 Pub/Priv Consortium Under Pub Agency	20 Incentive Reg	21 Pub Franchise	22 Business Franchise	23 License	24 Concession	25 Leasing	26 Gov Aegis	27 Mono Reg
Pre-Deployment 1 Prog/System Manager	—																															
2 Cost Sharing	•	—																														
3 Partnering	•	•	—																													
4 CRDAs	•	###	•	—																												
5 Design/Build/Op	•	•	•	•	—																											
Deployment 1 Pure Pub Prov	•	•	•	•		—																										
2 Pub Owner-Builder	•	•	•	•		•	—																									
3 Std Low-Bid	•	•	•	•			•	—																								
4 Lifecycle Contracting	•	•	•	•	•				—																							
5 Perfor Contracting	•	•	•	•	•		•		•	—																						
6 Pub Turnkey	•	•	•	•	•			•	•	•	—																					
7 Priv Owner-Builder	•	•	•	•	•							—																				
8 Priv Turnkey	•	•	•	•	•				•	•			—																			
9 Priv Competition	•	•	•	•	•								•	—																		
10 Pub/Priv Competition	•	•	•	•	•			•	•	•	•				—																	
11 Auctions	•	•	•	•	•						•		•	•		—																
12 Yardstick Comp	•	•	•	•	•												—															
13 Open Solicitation	•	•	•	•	•		•		•	•	•	•	•					—														
14 System Manager	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	—													
15 Cost Sharing	•	•	•	•	•					•	•	•	•			•		•	•	—												
16 Jt Ownership	•	•	•	•	•			•	•	•						•		•	•	•	—											
17 Funct Div Resp	•	•	•	•	•		•			•	•	•	•			•		•	•	•	•	—										
18 Comp Jt Vent	•	•	•	•	•				•	•					•			•	•	•	•	•	—									
19 Pub/Priv Consortium Under Pub Agency	•	•	•	•	•			•	•	•	•	•			•	•	•	•	•	•	•	•	•	—								
20 Incentive Reg	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	—							
21 Pub Franchise	•	•	•	•	•				•	•	•					•	•	•	•	•				•	•	—						
22 Business Franchise	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	—					
23 License	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	—				
24 Concession	•	•	•	•	•				•	•	•					•	•	•	•	•				•	•	•	•	•	—			
25 Leasing	•	•	•	•	•	•	•	•		•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	—		
26 Gov Aegis	•	•	•	•	•				•	•	•				•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	—	
27 Mono Reg	•	•	•	•	•				•	•	•					•	•	•	•	•				•	•	•	•	•	•	•	•	-

• = compatible to at least some small degree

- Public/private consortium under public agency (intermediary)
- Public franchise
- Concession
- Leasing
- Monopoly regulation.

- The models most conducive to ATIS deployment and which FHWA and the ITS community should evaluate further are:

  - Lifecycle contracting
  - Performance contracting
  - Public turnkey
  - Private owner-builder
  - Private turnkey
  - Private competition
  - Auction
  - Open solicitation of public/private partnerships
  - System manager
  - Cost sharing
  - Joint ownership
  - Functional division of responsibility
  - Competitive joint venture
  - Public/Private Consortium under Public Agency (Intermediary)
  - Public franchise
  - Business franchise
  - License
  - Concession
  - Private provision under government aegis
  - Monopoly regulation.

Pre-deployment activities accommodate many different ways the public and private sectors can work together both prior, during and after implementation of ATMS and ATIS. Thus there should be a diversity of pre-deployment activities that not only accommodate different proven approaches to public/private participation but also lay the ground-work for new approaches to deployment.

Recommendations

- The national system architecture should be flexible enough to accommodate a wide variety of different working relationships among the public and private sector such as those listed above. Phase II of the national system architecture effort should test the sensitivity of the final design concept to different models of public and private participation.

- Some models of public/private participation are suitable to both pre-deployment and deployment. Various forms of turnkey projects involving design and build as well as system manager fall under this category. In these cases where there are significant payoffs to integrating the design and build phases, theses approaches deserve strong consideration.

- Instead of conducting operational tests of various institutional arrangements, the government should conduct demonstrations aimed at deployment. Deployment demonstrations should involve the models of public/private participation most conducive to the full implementation of ATMS/ATIS. Demonstrations should provide metropolitan regions and states with successful models of implementation that can be emulated by others. Demonstrations should be fully documented and evaluated. Demonstrations could be' reduced to a modest number which collectively combine nearly all the favorable approaches, as follows:

  (1) Public franchise for (a) ATMS or (b) ATIS including surveillance requiring use of public rights-of-way. A public franchise should include at least one feature reminiscent of a business franchise, i.e., conformity with national standards, which assures some uniformity and compatibility nationwide. A demonstration of the public franchise model should include other approaches to deployment, possibly including minimizing lifecycle costs, perhaps through a design-build-operate-turnover (BOT) project; incorporation of performance specifications in the bidding process; auctioning the right to the franchise; and leasing property and equipment.

  (2) Public/private consortium under a public agency for (a) ATMS and (b) ATIS. This approach uses an intermediary between the public and private sector and can incorporate cost sharing, joint ownership, leasing, a franchise, a concession, design-build-operate, lifecycle contracting, performance contracting, and many other approaches to deployment.

  (3) Competitive joint venture where owners of the ATIS data base compete with one another in selling ATIS services. Owners could be value-added resellers or even government agencies that own rights-of-way containing traffic surveillance equipment and ATMS components. The number of owners/marketers could be limited initially to attract investment and opened to increasing competition over time. The competitive joint venture could also be structured to involve both ATIS and ATMS to permit revenues from ATIS to be invested in expanding ATMS. This innovative and untested approach would include cost sharing and joint ownership in a manner that would be responsive to performance specifications and minimizing lifecycle costs for ATMS and ATIS.

  (4) System manager for (a) ATMS and (b) ATIS. The system manager would have discretion to implement the system in the most effective and efficient manner consistent with initial design and performance specifications. Demonstrations could distinguish between approaches that place more or less responsibility on the public sector for design responsibility and correspondingly give less or greater latitude to the system manager in the approach to implementation.

  (5) Open solicitation of public/private partnerships. Several, if not a great many distinct implementation approaches are likely to emerge from a demonstration of this model. The reason is it involves a competitive process of soliciting and selecting multiple public/private sector joint venture projects that merit implementation. This deployment demonstration might be limited to ATMS or ATIS projects, to ITS projects in general or to a broader set of public/private joint ventures for potential inclusion in a Transportation Improvement Program (TIP).

(6) Comparison of purely private competition with public/private competition in the provision of ATIS. This demonstration might be for award of two or more maintenance or operations contracts once an ATMS/ATIS was implemented.

In developing a strategy for conducting deployment demonstrations of these or other institutional models, FHWA needs to set priorities based upon a careful examination of the effect each approach will have on speed of deployment, public and private benefits, and the risks and costs involved.

Necessary but not sufficient conditions for monopoly or somewhat exclusive provision of ATMS/ATIS user services are the following:

1. ***There are large fixed costs or large lumpy investment requirements for added capacity.***

2. ***There are significant economies of scale. Economies of scale can result from declining average costs in production or manufacturing, the need for centralization of data and information exchange, the need to avoid duplicative rights-of-way and use of public facilities, and the benefits of network services (transportation, telecommunications) being greater than isolated stand-alone facilities or service.***

3. ***Speed of deployment would be significantly lower if the service were competitively provided.***

A sufficient condition for monopoly provision is that the net benefits over the entire lifecycle to the public and private sector of such an approach are greater than competitive provision.

Recommendations

- In general, basic (free or very low cost) ATIS services needs to be publicly provided and value-added ATIS services should be privately provided in the competitive market place. If private service providers were to furnish both, revenues from value-added services could subsidize basic ATIS service, and potentially even offset part of ATMS deployment costs.

- Effective deployment of ATIS requires concerted actions to foster public and private cooperation. Both government and the private sector have valuable data for a comprehensive and responsive ATIS. Government may make key transportation related data available for free, provide the data on the condition it is a partner with the private sector, or sell the information to the private sector. Similarly, the private sector may provide the data for free if it engages in a profitable partnership or sell the private data to the public sector.

- ATMS should generally be publicly provided unless a highly vertically integrated consortium can generate the revenues from ATIS and other sources to cover costs and deploy both. Government can easily justify public provision of ATMS through some type of contracting. In special cases where a revenue stream from a consortium seeking to deploy both ATMS and ATIS is large enough, the granting of exclusive or partially exclusive rights to use or gain access to public property may be warranted, as in the case of franchising. ATMS, unlike ATIS, generally requires access to and use of public rights-of-way for connections to controllers, traffic signals, ramp meters, variable and message signs. Also, the traffic control equipment is likely to be under the control of a single traffic management center, except for

a back-up center designed to ensure system reliability. ATIS, consisting largely of traffic surveillance, database and telecommunications services, is not tied to the public infrastructure to the same extent as ATMS, and can potentially be totally divorced from it, thus facilitating private provision and competition.

- It is important to mitigate the adverse affects of any monopoly power possessed by the ATMS service provider. To prevent excessive prices and to promote the greatest amount of public benefits, free ATMS user services deserve strong consideration. If toll collection is an integral part of ATMS, government needs to regulate the size of the tolls and the return on investment of any private provider.

- Model franchise agreements for ATMS and ATIS should both be developed, but such an agreement for ATMS appears to have more merit than one for ATIS. Model franchise agreements should be developed in modular fashion so the clauses can be picked and applied to a wide variety of situations. For example a module of the ATMS franchise agreement might pertain only to a situation where ATIS basic services are free or low cost.

I. CHAPTER ONE - MODELS OF PUBLIC/PRIVATE PARTICIPATION IN ITS

There are a large number of ways in which the public and private sector can organize to provide various types of ITS user services related to Advanced Traffic Management Systems and Advanced Traveler Information Systems. This report seeks to enumerate these arrangements and discuss their implications in terms of the following:

(1) Public versus private involvement over different stages of the lifecycle;

(2) Economic issues related to industry organization and benefits and costs;

(3) Potential adaptability of alternative public/private participation arrangements to ATMS and ATIS; and

(4) Effect of alternative approaches on the speed of deployment and market penetration of ITS services.

Any ITS user service related to ATMS or ATIS will pass through a number of stages over its lifecycle. These stages typically involve design, build, operation, and maintenance. The relative roles of the public and private sector in bearing the costs for each of these stages of the lifecycle vary and depend partly upon the initial ownership and the particular public/private sector arrangement. With ownership goes the rights and control over the property's use and the ability to sell the property or earn revenues that flow from it. Final ownership, if different than the original ownership, also may significantly affect the final distribution of costs (and revenues) between the public and private sector through the sale (or lease) of assets and services. Public benefits also vary with different public and private sector roles. Neither the public nor private sector should be viewed monolithically. Each is composed of a large number of different organizations, and so there will also be changes in the distribution of costs within the private and public sector as the stage in the lifecycle shifts from one to the next.

The applicability of different institutional approaches to the deployment of ITS and the most desirable balance of public and private involvement depends on how various issues commonly addressed in the fields of regulatory economics and industrial organization are resolved:

- Barriers to entry and exit that may limit competition or prevent a firm from abandoning a market;

- Conditions of natural monopoly. This means the initial provider, through the existence of economies of scale, can expand output, undercut the price of competitors and drive them out of the market. It may also mean the provision of additional facilities duplicates the original one.

- The potential for full or partial cost recovery. Consumer and/or taxpayer willingness to pay is necessary for cost recovery.

- The ability to account for lifecycle costs and internalize external costs and benefits. An example of an externality is air pollution emissions from individual vehicles that contribute to a regional air quality problem.

- Prices charged consumers, including whether user services should be free in order to maximize benefits, and the potential of monopolists to charge excessive prices, thus requiring price regulation.

- The magnitude and distribution of benefits to the public and private sector.

Each form of private/public participation has different strengths and weaknesses in terms of its adaptability to ATMS or ATIS. Some approaches are well-suited to both ATMS and ATIS. Other approaches are well-suited to one, and some are well-suited to neither. Note that because both ATMS and ATIS are composed of many user services, it is possible that a particular model of private/public involvement may be well-suited to one type of user service but not another.

Speed of deployment has been a major concern in the management of the United States ITS program in the face of growing congestion, burgeoning business opportunities, and foreign competition impacting the automobile industry. It is important to evaluate the impact of various approaches to private/public sector involvement on the speed of deployment. Some approaches are likely to retard deployment whereas others may accelerate it, and the pace of deployment and degree of market penetration may differ substantially depending upon whether ATIS, ATMS, or both are involved.

II. CHAPTER TWO - ISSUES AFFECTING THE DESIRABILITY OF PUBLIC OR PRIVATE PROVISION

When is private sector activity appropriate and when is public intervention desired? Some sort of public intervention may be desired in the following instances:

- The good or service is a public good;
- There are other externalities associated with consumption of the good or service or with its production;
- The transaction costs of market organization outweigh those of public provision;
- The market is a natural monopoly or natural oligopoly; and
- Large public benefits can be realized but the risk of investment or production is so great that the private sector will not supply a desired good or service.

While these sources of market failure are sometimes discussed as through they are distinct, in fact they often are interrelated.

Even when one or more justifications for public sector involvement may be present, private sector participation may also be desirable. Notwithstanding the fact that a large percentage of businesses fail in their first few years of operation, it is difficult for the public sector to replicate the private sector's knowledge about market characteristics, such as factor input costs and demand and the efficiency signals of market prices. Public sector activity is unlikely to be an improvement upon private activity, unless combined with private sector participation.

A. Public Goods and Other Externalities

The desirability of public vs. private ownership/production or provision depends on the characteristics of the good or service. In particular, it depends on the extent the good or service is a private good or a public good. A "pure public good" is automatically provided to all people once provided to any. In addition, the marginal cost of additional consumption is zero. Examples of pure public goods include street lighting and national defense. These goods cannot be selectively supplied to consumers and consumption is "non-rival," meaning the amount one person consumes does not affect the consumption of another. A common characterization of a pure public good is it is impossible to charge for individual use, and furthermore inefficient to levy such a charge.

A "pure private good" allows exclusion. Without some degree of exclusion, a product or service, will not be able to command a market price, since anyone can get access to it and consume it. Private firms will not provide a product or service unless there is some degree of market exclusivity. The ability to exclude and thus to charge for use means that one can recoup the costs of private investment. Exclusivity, however it may occur, tends to create value for products and services. Their value is reflected in prices and prices exclude those unwilling to pay.

In the case of a "pure private good," congestion costs are positive so that charging for use results in the scarce benefits going to their highest-valued use (note: charging a price may itself be very costly. This is discussed in the section on Transaction Costs below). People who use free roads assume they are "pure public goods", when in fact, congestion costs, experienced as extra travel time, serve to ration use of the roads. It is possible to impose additional congestion charges, say through electronic toll collection, which could be used to ration scarce highway facilities even more effectively than travel time.

Traffic information broadcast on the radio or television is an example of a pure public good (at least to those that have a radio or TV) since any one can tune in to obtain the information and by doing so, no one else is excluded from doing the same. A major question for the provision ATMS and ATIS user services is the extent traffic data should be considered and treated as a pure public good. Should not traffic data useful for pre-trip planning, route guidance and traffic control be available in the same manner as traffic information broadcast over the radio and TV? The fundamental question is whether provision of traffic data at zero price will yield greater benefits, in relation to the costs, than would provision at a positive price.

The benefits of treating traffic data as a pure public good is equal to the sum of the public and private benefits. The public benefits (those accruing to the public at large) are the reduction in travel time, accidents, pollution and energy consumption that result from having free traffic data and not entirely reflected in the private benefits (profits) that result from more efficient provision of goods and services (note: there should be no double counting). The public sector or the private sector could theoretically pay all of the ATMS/ATIS deployment costs, but in most practical circumstances, maximum public benefits cannot be realized without private investment and maximum private benefits (profits) cannot be realized without public investment.

The net benefits of providing traffic data free of charge would then be the sum of the public and private benefits less the costs of providing the traffic data and less any costs associated with forgoing competition which might result in greater service quality. The advantage of treating traffic as a pure public good is the information would be available to the largest number of people at the lowest possible price, and public benefits would be the greatest as long as necessary supportive private investment were forthcoming. However, cost recovery is problematic.

If a positive price were charged for the traffic data (say, price equal to average cost), there could be full cost recovery. The revenue earned from selling the traffic data would be just offset by the cost of producing the traffic data, so cost responsibility by the public sector would be reduced. However, as a result of charging for the traffic data, the magnitude of the public and private benefits would be less than if the traffic data were free because the data will not be used as much. Part of the reason is the private sector would invest less than if the traffic data were free, since its expected return would be less.

Rather than settle on providing traffic data at zero cost or a positive price, it may be possible to organize the payment and pricing of traffic information service so that the public and private sectors both have input.

Most goods and services have a mix of private and public good aspects. For example, a movie playing in a theater with excess capacity (seats) has zero marginal consumption cost, yet consumers can be excluded since consumption requires entrance into the theater. While it is possible to charge for individual consumption, such charges create inefficiencies. Some consumers will be unwilling to pay the charge and will not consume even though the cost of additional consumption is zero.

The R&D phase of production generally has public good characteristics because it is often difficult to prevent others from copying the technology once the product is marketed (exclusion is difficult). This is clearly a major issue regarding the deployment of ITS. Patents are one way to enable the developer to capture the benefits of the R&D and thus give the developer incentive to engage in R&D activities. However, the product itself is usually a private good in that consumption by one person decreases the

amount available to others (often manifest in part by congestion) and the consumption can be monitored and a price charged.

Infrastructure contributes to economic growth, which creates an external benefit for future generations who are unable to participate in the market. There are also network externalities associated with infrastructure, in that the value of a given link will depend on the existence of other parts of the system. For example, a bridge over a river has little value if there are no roads leading to and from the bridge on either side. This situation means that expansion of the network increases the value of the existing network.

Private provision of pure public goods will be inefficient because the private firm is unable to capture the benefits of production. Clearly, a private firm requires payment for its product or it will be unwilling to incur the costs of production. Furthermore, if a good has some public good aspects, the good may be under- or over-supplied by the private sector. For example, landscaping has a private benefit to the land owner, at least part of which a supplier can extract. However, it may also benefit others by providing a pleasing sight to passers-by, for example. The supplier will be unable to tap this external benefit and thus these benefits may be undersupplied. Analogously, negative external effects may be over-supplied. Pollution is an obvious example.

Alternatively, if all those who have an interest in the good or service can be organized to participate in its production, and costs shared, then the optimal amount of the good or service will be produced. However, for lumpy projects, there will likely be disputes about how to share costs and these may even make such collective action impractical. This is because each individual's benefit is not tied to the amount he/she contributes.

If private firms cannot entirely capture the benefits of production of a good because there are public good aspects, then public input through subsidization can expand output.

B. Basic Service, Product Differentiation, and Pricing

One reason for treating traffic data and ATMS user services as a "pure public good" is to provide universal service to people of all incomes and geographical areas. There is a fundamental tension between providing universal service for key ATMS/ATIS user services and ensuring full cost recovery to promote investment. Offering universal service implies no- or low-cost service to end users so that price is not a barrier to people with low incomes. However, no- or low-cost service is incompatible with cost recovery.

The opposite approach to free or low-cost service is to price according to willingness to pay and try to extract all the consumer surplus, the difference between the price people actually pay and the price they are willing to pay — in other words to practice price discrimination. In the ATMS market, which may have significant economies of scale and therefore natural monopoly characteristics, a firm (or firms) with monopoly power can try to charge a different price to each person according to their willingness to pay. While public policy might not permit firms with monopoly power to use discriminatory pricing, the monopolist can use product differentiation as a basis for price differentiation among buyers. The ability of the monopolist to extract all that people are willing to pay presumes the buyer is not seeking to resell the product or service. Note also that even a perfectly discriminating monopolist may want to restrict output and not serve the low income end of the market in order to maximize profits.

Indeed, the attainment of simultaneous goals of universal service and cost recovery might require that basic service for each ATMS/ATIS user service be offered for free or at very low cost, while value added services be clearly differentiated so as to warrant pricing according to what people are willing to pay. Examples of basic ATMS/ATIS user services that might be free or very low cost are as follows: ,

- Pre-trip planning: Travel costs (time and money) by mode, route and time of day for any origin and destination specified.

- En-route driver information: Critically important signing information such as stop and yield signs.

- Route guidance: Digital map display and associated turn information resident in an in-vehicle data base coupled with sufficient real time information regarding the relative travel time and costs of alternative routes for completing the trip. Basic service for route guidance might consist of providing directions between origin and destination in terms of voice, text, and digital map display.

- Ridematching and reservation: Providing the traveler ridesharing options, given an itinerary including date, time, origin and destination.

- Traveler services information: The location, availability and directions to such essential roadside services such as fuel (gas, electricity), food, lodging, and emergency services.

- Traffic control: Information and telecommunications for control of traffic signal systems,' ramp meters, reversible lanes, access to HOV lanes, and incident management.

Depending upon how user services are structured and the manner in which information is gathered, some of these services might be regarded as more fundamental than others. For example, traffic control and pre-trip planning might be considered basic services with all the others listed above regarded as value-added services.

Value-added sellers could bundle those basic services offered for free or at low cost with other information and services useful to specific markets and could attempt to price the value-added service to reflect the full worth to the buyer. To the extent the provider of basic service can share in the revenues of the value-added reseller, there can be progress toward cost recovery for the basic service. A related issue is whether one can erect an effective mechanism to enforce and prevent black-market resale of free information and services to those targeted to pay higher prices.

As an example of this two-tier system of charges, imagine a situation in which basic telephone service (connection and 30 local calls per month) is provided free of charge, but that special services — long distance, more than 30 local calls, call-waiting, etc. — carry positive prices that reflect not only the marginal cost of providing them, but perhaps the cost of providing the basic service as well. In effect, users of special services would subsidize users of basic service.

C. Economies of Scale and Natural Monopoly

If it is possible to exclude consumers and thus charge for use or consumption of a good, then private provision is feasible. If furthermore, the cost of additional consumption is non-zero, then charging

for consumption is efficient. However, monopoly may be the optimal market structure due to cost savings from centralization or economies of scale. Hence, even for pure private goods, the institutions of public ownership or regulation are sometimes used. Economies of scale can arise in a variety of ways. First, the addition of productive capacity may result in declining unit (average) cost through the relevant range of demand. Manufacturing of in-vehicle ITS equipment would be expected to exhibit declining average cost for increasingly greater manufacturing capacity. Second, duplication of facilities resulting in excess capacity can be avoided. For instance, only one fiber optic cable is required for arterial street signals operating under real-time adaptive control. Permitting a second fiber optic cable to be installed might create an opportunity for competition, but there would be extreme excess capacity. It is difficult to see how more than one provider could operate the signals. Third, economies of scale arise where centralization produces efficiencies. When all traffic-related data is funneled through a traffic management center, the possibilities of successfully managing traffic on an area or region-wide basis increase in comparison to when only local information is available locally.

The presence of economies of scale has major implications for cost recovery. If both short and long run average costs are declining, then the marginal costs will also be declining. If one tries to charge the efficient price — price equals marginal cost — then the price is insufficient to cover total costs since the price per unit is less than the average cost. This implies either that average price has to be charged for cost recovery, which is not the efficient price, or that the efficient price can be charged, but the service will require a subsidy, usually provided by taxpayers.

Another consequence of an industry with declining average costs is that the competitor with largest output will have lower costs than any competitor. The firm with the greatest output can then underprice its competitors, and drive them out of the market. Taken to an extreme, eventually only a single firm will be left as a monopoly provider. An industry with significant economies of scale conducive to this type of destructive competition is called a natural monopoly.

D. Efficient Level of Output

In theory the optimal level of output of a firm or industry producing private goods occurs where marginal revenues equals the marginal costs. The firm or industry would take into account only internal costs, not external costs. For a region, the efficient level of output occurs where marginal benefits equal marginal costs, including all internal and external costs and benefits. Any greater or lower level of output would result in the difference in costs exceeding the difference in benefits. Understanding the efficient level of output is useful for judging whether a particular model of public/private participation is likely to under or oversupply ATMS or ATIS, especially when there are externalities such as congestion or positive spillover benefits present.

A similar criterion applies to the optimal level of production of a pure public good. Output should be expanded up until the point where the marginal cost of production is equal to the sum of the individual marginal benefits received by all residents of the community where the public good is produced. In other words the marginal social benefit of the public good is the sum of the benefits that accrue to any one person plus the benefits that accrue to the other members of the community.

When production of a good or service generates external effects positively valued by every member of the community, the producer will tend to under-produce relative to the efficient output level unless the producer is assigned property rights to the production and can charge those who benefit. When a good

or service generates negative external effects, the producer who is not required to pay for causing the adverse effects will produce more than the efficient output level,

The private sector is likely to under-produce ATMS and ATIS because of the presence of positive externalities. The improvements in regional traffic flow due to ATMS and ATIS that benefit every jurisdiction in a region, above and beyond the local effects, is an example of a positive externality. Another example of a positive externality are the benefits of infrastructure with long life that spills over to the next generation from the users who benefitted and helped pay for it.

Furthermore, if the public sector provides information services at zero price, then the telecommunications network may become congested from use — that is, provision of information to more people may no longer be virtually costless. If prices for travel data do not reflect congestion costs on the telecommunications network (for example, through peak period pricing), then the ATIS system may not be optimally used.

Note that when traveler information is underproduced, then there will be more road congestion, a negative externality, which leads to overuse of highways in comparison to the efficient output level.

E. Market Structure

One, a few, or many firms can provide an ATMS or ATIS user service. The choice of the best model of public/private participation depends on the market structure most conducive to deployment over the short, mid and long term.

In the short run, it may be necessary to guarantee a service provider sufficient share of the market in order to compensate for the risks and earn a reasonable return on investment. Even when a good or service is essentially private in nature, so that market supply is feasible and desirable, minimizing the cost of producing sometimes means that only one or a few producers should be active. This is particularly true in markets with strong natural monopoly characteristics. In such instances monopoly, duopoly or oligopoly market structure, coupled with price and output regulation, might be desirable. However, when there are but a few active producers operating in a private market, they are likely to have market power, restrict output and raise prices.

In such cases involving a few private firms, the only way to improve allocative efficiency is to remove or reduce the profit motive. This is achieved through either public ownership or regulation of private producers. Public ownership and regulation can each take many forms. A single agency might have ownership or many public agencies could share in the ownership and assume different responsibilities. Regulation may consist of legal restrictions or may involve a regulatory framework such as that governing telecommunications or investor-owned electric utilities.

As the ATMS/ATIS industry matures, the chicken-and-egg problems inhibiting initial deployment may be overcome once the publicly and privately provided infrastructure (including in-vehicle equipment) is in place to realize significant public and private benefits. At this juncture, the industry structure that was most conducive to initial deployment may no longer be most appropriate. To foster innovation and the development of second generation technology and services, a more competitive environment would be desirable. Where there is sufficient demand and profit opportunities to reward many investors, a competitive environment would be best since it helps to keep costs and the price to consumers down in a more efficient way than rate and output regulation.

In the long run products and services will continually evolve in a competitive environment, but would be much less likely to do so in market with just a few suppliers. Consumers would probably most benefit from the competition in terms of steadily declining prices for products and services of increasing quality, just has occurred in the personal computer industry.

F. Antitrust

A key ingredient to successful deployment is observance of antitrust law. Antitrust law is designed to protect against collusion in the market place and to keep firms with excessive market power, due to industry concentration or natural monopoly conditions, from destroying their competition. Antitrust law is also predicated on there being sufficient competition, or the threat of sufficient competition, so that consumers are not charged excessive prices.

Far from being a barrier to deployment, observance of antitrust law may be essential to rapid deployment that is not unduly harmful to certain service providers and to consumers. Each model of public/private participation needs to be scrutinized carefully to determine whether it would promote conditions that would run afoul of antitrust law. Some models are very sensitive to such issues, especially where there is joint ownership or cost sharing among various investors and service providers or where there are governmentally imposed restrictions on entry. In the latter case, the state action doctrine (i.e. when state laws authorizing certain actions such as exclusive franchises exempt such actions from antitrust regulation) may limit the applicability of antitrust law to ITS providers.

G. Distributional Issues

The distribution of benefits among ITS providers and among transportation users is a politically charged issue. Unless handled well it could potentially become an obstacle to ATMS/ATIS deployment. There is strong sentiment within Congress to ensure universal access to the "national information superhighway." The information highway will be a collection of wired and wireless networks in local and regional settings that will be interconnected. It will be owned by private, public and public/private entities. Given that ITS will use this telecommunications infrastructure, it is likely there will be equally strong pressures for universal access to basic ITS user services.

If basic ATMS/ATIS is provided for free or very low cost, the question of who will pay for deployment remains. Most likely part or all of the public costs of initial deployment will be recovered through other types of user fees or taxes. The distributional impacts will depend upon how regressive or progressive each of user fee or tax is. Historically, the gas tax, even though it is regressive, has been viewed as the most palatable way to pay for highway construction costs. Congestion pricing is more problematic and has yet to be accepted as a viable highway finance strategy. However, in the long distance telephone industry, where universal access is a public policy, congestion pricing is widely employed.

The distribution of benefits and costs experienced by the public sector will depend partly upon whether there are spillover effects and free riders who benefit from positive externalities without paying for them. If jurisdictions within a region benefiting from ITS user services escape from paying a share of the costs, then there will be free riders. Due to the complexities of negotiating equitable agreements among all governments in a region with large numbers of jurisdictions, free riders are to be expected. This could create considerable resentment among jurisdictions that are willing to share in the costs deployment, and could potentially undermine their commitment as well. There is also the free rider .

problem with highway users. Businesses that rely on transport will be large gainers and free riders unless they are charged.

ATMS/ATIS deployment will result in different possible distributions of benefits (i.e. profits), among the private sector. If ATMS and/or ATIS proves to have strong natural monopoly characteristics, one possible outcome is destructive competition, where the largest supplier(s) drives their competitors out of business by continually underpricing them. Other industries, such as electric utilities, mass transit, and the railroads, have experienced destructive competition early in their evolution. This led to public utility regulation and antitrust actions. An outcome more likely than destructive competition in ATMS/ATIS businesses is either healthy competition or some degree of regulation.

A major shift in the distribution of benefits and costs can also occur between the public and private sector, even within a regulated industry. For example, it is not uncommon for a firm in an industry with economies of scale to be awarded a regulated franchise monopoly. At the outset there is an agreement as to the maximum that the consumer (ratepayer) can be charged, the rate of return on investment, and the base (rate base) on which the return on investment will be charged. After initial deployment, in certain service areas there may be excess capacity, so the firm is unable to recover its costs in those locales. Frequently the firm will then turn to the regulator (a state regulatory commission, for example), and ask that its unproductive investment be removed from the rate base or the rates increased to cover unproductive investment, and have the onus of cost recovery placed on the ratepayer. Over time, the investors who own the firm end up with the most valuable and productive assets while the costs of covering the unproductive assets shift to the consumer (ratepayer). Many franchise monopolies understand full well that shifting the costs over time from the investors to the consumers is one of the most effective ways to minimize risk and maximize their return on investment. Ratepayer advocacy groups are not oblivious to what is going on. For this reason rate hearings before public service commissions are often very acrimonious.

H. Game Theory and Suboptimal Outcomes

Some models of public/private participation may be vulnerable to poor outcomes that are predictable by game theory. Each public and private participant in the deployment of an ATMS or ATIS system will be seeking to strike bargains that maximize their own benefits. However, the realization of benefits is uncertain. Each player soon realizes that different payoffs are possible with different probabilities attached. The outcome with the highest benefits may have a low probability attached to it, because it can be achieved only with exceptional and difficult cooperation. Because of the difficulty in achieving the cooperation, participants may settle for a less satisfactory outcome for all involved.

Deployment of ATMS/ATIS will be rife with situations that are best understood from the standpoint of game theory. Some of these situations are:

(1) A regulated monopoly provider and ratepayers are engaged in a zero sum game. The monopolist seeks to maximize profits and shift the risks and costs of unsuccessful investments to the ratepayer, whereas the ratepayer will seek to have the monopoly's investors incur the risks and sufficient costs to provide low-cost service.

(2) Where a duopoly exists, each firm will behave so as to maximize profits. Game theory suggests they may not reach a profit maximizing or socially optimal equilibrium. Also, tacit collusion is much easier in a duopoly market.

(3) Each public agency in a multijurisdictional environment has strong incentives to benefit from a new ATMS/ATIS without paying their full share of costs, or perhaps any costs. A highly possible outcome is that deployment will be incomplete to the detriment of all involved if more than a few government jurisdictions can be free riders.

(4) Public benefits of reduced congestion, accidents, pollution and energy consumption depend on whether traffic managers can encourage drivers to use the least congested routes that are optimal from the standpoint of regional objectives but are perceived by local users as being suboptimal from their perspective. Individuals may perceive an advantage to not following the guidance of centralized traffic management.

(5) Obtaining maximum public benefits from centralized traffic management also requires tacit agreement from the private sector not to exploit potentially profitable opportunities of routing traffic on routes not recommended. Many firms in the private sector will strike an agreement to abide by the rules of the public sector, but other firms will not. For example, many commercial truck operators might agree to stay off neighborhood streets, but express mail delivery service might see travel time and cost advantages to using them, particularly when the centralized traffic manager is routing traffic away from such areas.

I. Efficient Pricing of Roads

ATMS potentially has major implications for efficient pricing of roadways, partly because electronic toll collection is considered part of the constellation of ATMS user services. Electronic toll collection makes congestion pricing feasible i.e. charging for marginal congestion costs. Each vehicle as it enters the traffic stream imposes some delay on other vehicles in the traffic stream. The extra increase in travel time is the marginal congestion. Since the installation of toll facilities on a previously free road would allow for exclusion of road users, it amounts to the conversion of a facility — a highway — with some public good characteristics into a private good. In the absence of a congestion charge equal to the marginal congestion costs, travel time rations the scarce roadway capacity, and capacity utilization is less efficient than it would be if there were congestion pricing.

As a practical matter, efficient pricing of roadways is difficult for a number of reasons. First, it may be perceived as inequitable or regressive, imposing more costs on the poor than the rich relative to their income. The second is that marginal cost pricing may or may not cover the full costs of the facility, which may be important for a new toll road that is to be financed from toll revenues. A third reason is the transaction costs may be greater than the benefits of efficient pricing.

J. Transaction Costs

One of the reasons we rarely exclude consumers from the benefits of a road is that it is costly to do so in terms of motorist inconvenience and toll booth operation. Transaction costs of operating a market — charging for use in order to recoup costs — may indicate that public ownership or at least provision at zero cost is the optimal mode of allocation.

Similarly, bargaining over every exchange (e.g. pieces of information related to highway conditions as in ITS) may make pure competition a very costly organizational form. Such costs are alleviated in the private sector by contracts that stipulate fixed average payments to replace per-unit flexible charges.

The Booz-Allen Hamilton study of institutional impediments to traffic coordination in metropolitan areas calls attention to the field of transaction cost economics, which concerns the design of institutions to regulate transactions between interdependent parties performing a complex task. Transaction cost economics usually assumes that some goal is worth pursuing and that the benefits of attaining the goal exceed the minimum transaction costs. Transaction cost economics then poses the question of what kind of governance structure minimizes the costs of the transaction. The Booz-Allen Hamilton study concluded that ATMS, with its combined characteristics of asset specificity and uncertainty, requires the creation of special governance structures to manage the transactions. Unfortunately, the study concluded that which governance structures minimize transaction costs cannot be answered a ***priori.***[1]

K. Lifecycle Costs

Efficient provision of ATMS/ATIS requires that decisions made at any stage in deployment fully consider all costs at subsequent stages. Therefore, at the design stage, it is important to consider not only construction costs, but also maintenance and operating costs.

The failure to fully account for lifecycle costs in decision-making can lead to higher overall costs or result in short or long run costs that are not fundable. Attempts to minimize operation and maintenance costs expected to occur over the long run could result in large short run construction costs, and vice versa. Models of public/private participation that force decision-makers to consider lifecycle tradeoffs at key decision points will reduce the overall cost of deployment. A related issue, especially germane to ATMS/ATIS, is the availability of funds and other resources (properly trained and educated personnel) to operate and maintain these systems. As stated in the Urban Institute study on ITS staffing and education needs, many agencies lack personnel with the requisite training and education to operate and maintain technologically advanced traffic management and other related information systems.[2]

L. Risk

Sometimes, while consumers are willing to pay more than the cost of production, they are unwilling to pay enough extra to induce an investor to take the risks of production. The amount of premium required to take risk depends on the vulnerability to loss. A single investor may be unwilling to take the chance that demand could fall or costs could rise. The "pooling argument" is that public backing spreads risk over more people. However, many argue that if the private sector is unwilling to risk a project, then the project should not be undertaken — the expected value is less than the expected cost. But sometimes the risk is in terms of regulation or government activity itself. Then public sector involvement can be reassuring to private investors. In other cases, the private sector underestimates the total return measured in terms of public benefits because the private sector cannot capture those easily. In any event, it may be wise for the public sector to underwrite a risky project even though the private sector is unwilling to proceed on its own.

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1 Booz-Allen & Hamilton, Inc., Institutional Impediments to Metro Traffic Management Coordination, prepared for the Volpe National Transportation Systems Center, September 13, 1993, p. 3-10.

2 William A. Hyman, et. al., IVHS Staffing and Education Needs, Final Report, prepared for Federal Highway Administration, August 1993.

M. **Information Asymmetries**

Public involvement may be worse than private provision even when market failures are evident and provide a rationale for public sector involvement in a market. The reason is government is generally less knowledgeable about market conditions than the private sector.

For example, regulation as a response to natural monopoly would be ideal if the regulator knew the price to charge that would maximize consumer welfare subject to a revenue constraint for the producer. But when the regulator lacks this information, it may choose a price that results in an allocation of output worse than monopoly pricing. Or the regulatory mechanism for limiting profits may lead the producer to use inputs inefficiently, resulting in productive waste.

Generally, the types of information needed to obtain efficient results concern demand and costs. If demand and technology are fixed, for example, then a regulator or government owner can learn the correct price over time through trial and error. Also, if the cost-minimizing technology is easily observed and implemented, then productive efficiency can be achieved.

Such information needs create a problem for public intervention in the form of public ownership, procurement, regulation, and monopoly franchising. In the past twenty years, researchers have attempted to account for the information asymmetries between the regulator and the regulated. "Incentive regulation" schemes have been developed that yield some improvements in efficiency. In general, however, information problems preclude the hope that public sector intervention in markets can fully correct market failures.

N. Issues in Private Sector Provision of ITS

In considering the workability of and outcome of private versus public sector provision, the preceding discussion leads us to ask several questions:

- For which services, and at what stage(s), can consumers be excluded from the benefits provided by the system? That is, for which stage(s) can a price be charged?
- For which services, and at which stage(s), is exclusion efficient (because of costs imposed by consumption) or should be avoided (because of the loss of positive externalities accruing to the public at large — reduced congestion, accidents, pollution, and energy consumption)?
- What are the transaction costs of exclusion at various stages?
- What is the optimal market structure to provide the various benefits of ITS? That is, where are there significant economies of scale in production?
- What are the options for reducing risk exposure?

In general, there are two dimensions of service provision offered by ATIS and ATMS: access to the system and use (consumption) of the system's output. Presumably, access to the system will be controlled by the need for consumers to have some type of hardware or a code number. It is less likely that use of the system by those with access can be cost-effectively monitored and controlled. Although

in theory, consumers could be excluded from (and a price charged for) either dimension of service provision, it is unclear how feasible this is in reality.

Is exclusion economically efficient? Part of the answer to this question depends on whether the marginal cost of consumption is positive. It may well be that the marginal cost both of additional users (gaining access) and of use by those with access is very small. Once an information system is in place, it is likely that the cost of providing that information to more people is near zero. Zero marginal consumption cost means that charging for consumption creates inefficiencies. However, the feasibility of private sector provision may be maintained by looking at the problem as follows: once investment has been made, then efficient use of the system requires a zero price, but ***prior*** to investment the efficient price is not zero, because provision of the system itself is costly. Therefore, an access charge can be justified by appealing to the fact that efficient investment requires that consumers be willing to provide cost recovery.

The other part of the answer depends on whether the benefits to the public and private sector are not worth the cost and risk of investment as a result of exclusion. Non-exclusion maximizes public and private benefits, but makes cost recovery problematic. ATMS and ATIS will realize the largest public benefits in terms of reduced congestion, accidents, pollution and energy consumption if traveler and traffic information is free to users. If it is not, then fewer people would be willing to pay, and the public benefits would be accordingly less. If traveler and traffic information is free, manufacturers of in-vehicle equipment and equipment for traffic control would have a larger and more profitable market than if not, stimulating investment and deployment of ATMS and ATIS equipment. This assumes, of course, that equipment suppliers can generate sufficient revenues to cover their costs. Obviously, if traffic data is free, it does not necessarily imply that traveler information coupled with traffic data will be free. Value added resellers can combine many different types of traveler data with traffic data to produce information people will pay for and therefore generate revenues.

As for transaction costs, these will be high if usage charges are imposed. For access, however, imposing fees is probably not too costly — the period of rental can be varied to find the cost-effective time period. Access may be given for life at a one time charge or it may be rented for, say, one year or one month at some rental rate.

To analyze the optimal market structure, it is useful to break up the stages of output into production and provision. ATMS and ATIS will consist of information gathering through various sensor and communication technologies; information processing at a central Information Processing Center (IPC); and information dissemination, including both information for voluntary use by individual users (ATIS) and control of traffic management technologies (ATMS) such as traffic lights, highway advisory radio, ramp meters, etc.

Information dissemination to individual users (ATIS) is most likely to be a decentralized activity. That is, processed information could be made available through various independent marketers. Under some public/private sector arrangements, the IPC itself, however, and possibly information gathering, could be centralized. For example, under some circumstances it might be wasteful to have duplication of the IPC since information gathered is going to have the most value when combined with other available information. Also, depending on the technologies employed, the gathering of information may have natural monopoly elements. It might be wasteful, for example, to have traffic information collected by more than one party.

However, if there is only one IPC facility, it will have market power. Public ownership of the facility or regulation of private ownership each involves costs to the public in terms of both on-going price setting and production inefficiencies due to the likely failure to minimize costs.

Risk is also related to market structure. A firm that holds a protected monopoly will be more willing to undertake risk since the expected benefit in terms of higher profits, will be greater, if the gamble pays off. Imposing competitive forces on the market increases risk and reduces the expected return. Models of public and private participation that facilitate risk sharing are attractive. The large scale exposure by one firm is not needed in order for that firm to be viable — or the venture to be viable — if the gamble pays off.

0. Speed of Deployment and Market Penetration

A key criterion affecting the desirability of different models of public/private participation is their impact on speed of deployment and market penetration. Some models of public/private participation will tend to accelerate deployment in the short run but could have an adverse effect on market penetration and competition in the long run. Other approaches may be more patient of institutional and technological changes that lead to long run profit opportunities and deep market penetration.

Speed of deployment also depends significantly upon the various models of public and private participation used in the pre-deployment phase.

III. CHAPTER THREE - PRE-DEPLOYMENT MODELS OF PUBLIC/PRIVATE PARTICIPATION

The public and private sectors can work together toward deployment in two phases. The first is the phase consisting of technology development, planning and design, system architecture development, and operational testing, which might be referred to as pre-deployment. The second is the deployment phase. In most respects, technological innovation is not a pre-requisite to ATMS/ATIS deployment. Many have argued that ITS is not a new technology but a marrying of many existing technologies. Some technology is part of the installed base of existing traffic management systems. Other technology was developed for national defense, but the technology can be converted to civilian use. Still other technology is part of the emerging telecommunications revolution, but this technology is also waiting for ITS to harness it.

While the marrying of existing technology will require its own planning and design and the development of software and equipment tailored to ITS, in some respects there is no sharp distinction between the pre-deployment and deployment phase of ATMS/ATIS. ATMS will piggyback upon many legacy systems involving traffic control centers, automated traffic control systems, highway advisory radio, and changeable message signs already in place. The key challenges in implementation of ATMS and ATIS are systems integration and overcoming institutional barriers to regional deployment. Much of the pre-deployment phase of ATMS and ATIS is focused on these issues.

The pre-deployment phase of ATMS and ATIS is characterized by the development of a national ITS system architecture and the carrying out of a large number of operational tests. Operational tests are designed to test one and often more, new technological,institutional and financial elements in a real-world setting. Operational tests are different from research projects or other kinds of testing using simulation models, test tracks, or on public roads temporarily closed to the public. Also, a large number of early deployment projects are being carried out. Early deployment projects also represent a grey area between pre-deployment and deployment. All operational tests and early deployment projects conducted to date have preceded the development of a national system architecture, and thus are inputs to its development. As the national system architecture crystallizes, operational tests and early deployment projects will increasingly conform with it. When the national system architecture has been adopted throughout the country, the ITS program will truly have passed from the pre-deployment stage into the deployment stage.

There are a variety of institutional arrangements involving the public and private sector that pertain most strongly to the pre-deployment phase. These include:

(1) Program/system manager
(2) Cost sharing
(3) Partnering
(4) Cooperative research and development agreements
(5) Design-Build-operate

A more detailed description of each of these approaches follows.

A. Program/System Manager

An approach to managing the early developmental phases of a major system requiring large public and private inputs is that of program or system manager. A public agency or a private contractor assumes

responsibility for the overall program development during the R&D, planning and design stages. The kinds of public agencies most likely to assume the role of program manager are a federal agency or administrative unit within it, a public corporation that serves an advisory role to the federal government, and national laboratories. State and local agencies are unlikely to fill this role when the system being implemented is national in scope. For state, regional or local systems, a corresponding government agency could very well serve as the program manager. Any private firm with the requisite technical and managerial expertise and resources could also potentially serve as a program manager. There is also the possibility of Co-program managers where one public and one private organization jointly administer the program. The role of program or system manager can extend into the deployment phase, as discussed further below.

The program manager concept, though vulnerable to cost overruns, has worked well in the deployment of many major systems, including the defense sector, and to Some degree is being currently applied to the development of the a national ITS system architecture. The Jet Propulsion Laboratory — working under a DOT ITS Coordinating Committee, a DOT ITS Working Group, and the DOT Architecture team, with inputs from ITS America, the Mitre Corporation, the Consensus Builder project and a technical review team — was designated program manager for the ITS national system architecture project (See Figure 1). The Jet Propulsion Laboratory provides administrative assistance, cross cutting technical analysis, and other oversight of the architecture development teams. Originally four teams were selected under a competitive contracting process to develop distinct initial concepts for a national ITS system architecture during the first phase. Subsequently two teams were selected to complete the system architecture in a second phase.

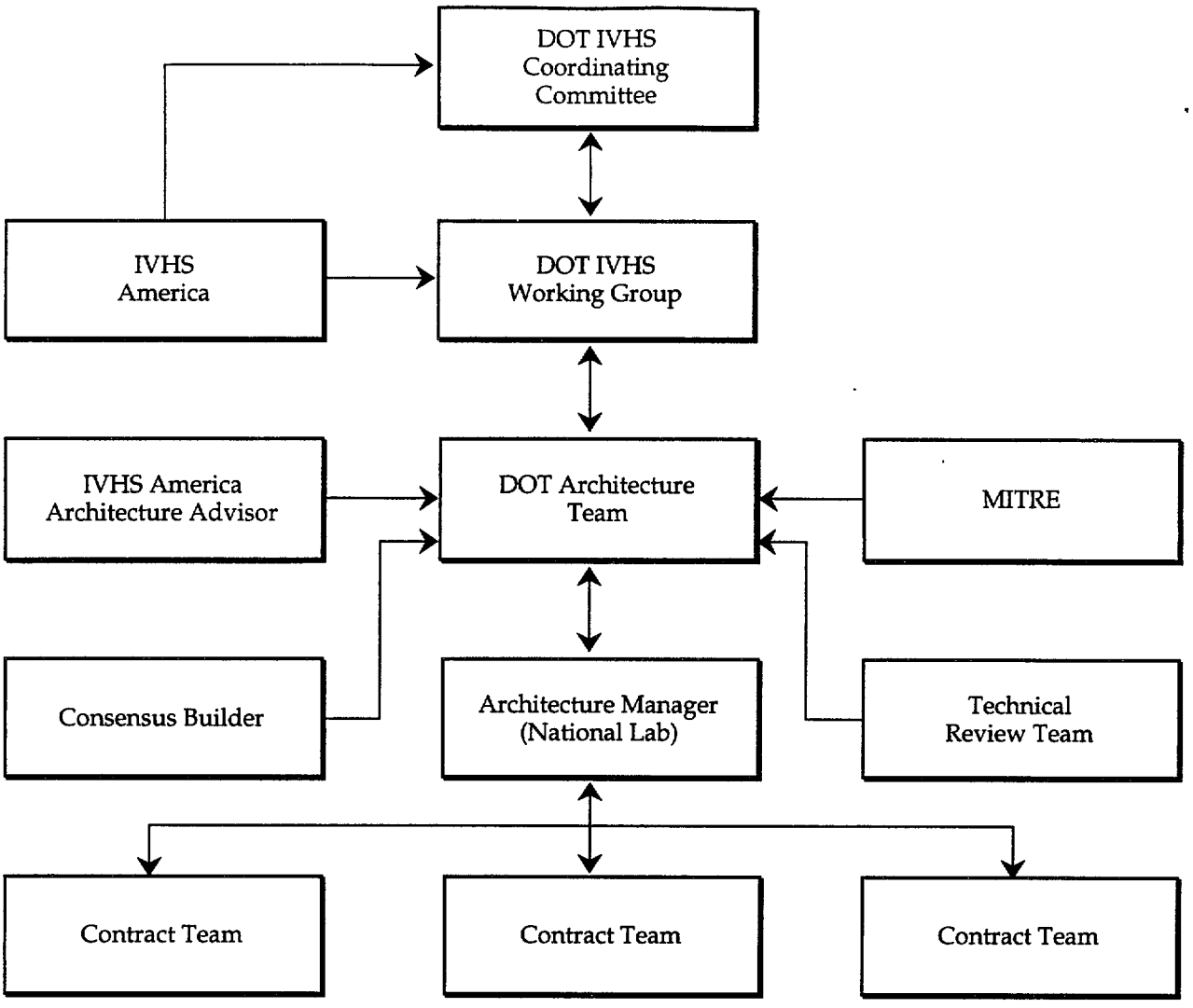
To date the process seems to have worked fairly well. It has been effective in reaching out to stakeholders around the country and has produced a wealth of technical analysis. It is becoming increasingly focused on standards development, as it should be, but to date has been light on development institutional frameworks consistent with the system architecture concepts. As this effort concludes with preparation of a deployment plan, it is expected the full range of institutional issues will be explored and the relevance of various deployment models will be determined.

B. Cost and Risk Sharing

The potential public and private benefits of ATMS and ATIS cannot be realized without public and private cooperation. Because each sector needs the other for anything resembling optimal deployment, both are willing to incur some of the direct costs or risks of pre-deployment. Risk is qualitatively different from direct costs. Direct costs are certain while risk consists of uncertain costs.

Many different public/private partnership arrangements can be devised to spread the direct costs and risks among the public and private sectors, both for national undertakings and more localized efforts, whether at the state, regional, or corridor level.

Experience in Europe regarding ITS suggests that cost sharing is a workable framework for public/private partnerships at the program level during the pre-deployment phase. In the original DRIVE program, the European Community's (EC) contribution was 50 percent of a company's allowable costs, which consists of labor, capital, equipment and depreciation, as well as other direct costs and overhead. Thus a private company had to bear 50 percent of the costs of participating in a DRIVE project. For DRIVE II projects, the EC's contribution was reduced to 30 percent. Incentives for firms to participate include the ability to earn a profit on the non-EC portion of funding, retention of intellectual property



Note: **This diagram is for DOT administrative purposes only.**
Source: **U.S. DOT**

Figure 1. IVHS Architecture Program Management Structure

rights, and the ability of one firm to have 50 percent share of costs covered by others in a project consortium.

In the Eureka element of the PROMETHEUS program in the United Kingdom, the government offered funding support on a sliding scale: 50 percent for feasibility studies; 45-50 percent funding for work leading to the full definition of R&D projects; 30-45 percent funding of pilot projects; and 25-30 percent funding for nearer to market elements.[3]

In the United States there has been no single formula for cost sharing for R&D and operational tests, but the private sector has been expected to make significant contributions either in money or in kind. Memorandum's of Understanding and Cooperative Agreements have been used to establish the relative public and private sector responsibilities for carrying out operational tests, which vary from one site to another.

C. Partnering

Most of the joint working relationships between the public and private sector within the ITS arena to date have been predicated on the idea of a public/private partnership rather than formal cost sharing relationships. Partnering between the public and private sector extends from the activities of ITS America to specific operational tests. ITS America is an educational and scientific non-profit organization chartered as a federal advisory committee to the U.S. Department of Transportation. Its members include private firms, universities, associations, federal, state and local government agencies and individuals that constitute a grand partnership devoted to the deployment of ITS.

ITS operational tests are typically carried out as cooperative public/private ventures, though they may involve only public sector partners that use competitive procurement to obtain private participation. The partnership aspect distinguishes an operational test from normal contract procurement. Operational tests occur under a partnership agreement negotiated among federal, state, local, private and other institutions. The partners share funding, technical and administrative responsibilities. Partners may pool funding or not.

One form of a partnership is a cooperative agreement with one or more consortia selected through a competitive process. Consortia can be composed of entirely private organizations or a mixture of private and public entities. This is the approach the U.S. Department of Transportation has taken with regards to the Automated Highway System Program (AHS). The Federal Highway Administration has formed a cooperative relationship with a national consortium to provide the management and technical skills to carry out the system definition and feasibility analysis for automated highway system. This phase is to be followed by a phase in which a preferred automated highway system will be implemented in various sites in the United States.

The consortium was assigned the following responsibilities in the DOT procurement:

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3 Castle Rock Consultants, "IVHS Experience in Europe," paper presented at workshop on "Public and Private Sector Roles in Intelligent Vehicle-Highway Systems (NHS) Deployment," in Rockville, Maryland, April 8-9, 1992.

(1) Provide leadership and focus to the nation's AHS effort;
(2) Reflect the concerns of key stakeholders (road users, environmental groups, equipment and service providers, government, etc.) in the design, deployment and operation AHS;
(3) Pursue the vision, goals, purpose, and desired cooperative relationships of the program;
(4) Help manage the national effort.

The roles of the U.S. Department of Transportation are:

(1) Help establish this cooperative relationship by funding a share of the costs;
(2) Work cooperatively with the consortium to provide focus and leadership to the nation's AHS efforts;
(3) Undertake selected studies that are needed in cooperation with the consortium;
(4) Represent the public interest; and most importantly
(5) Provide funding.

The consortium was never seen as a specific structure to carry out the AHS program. Groups were encouraged to propose any structure they felt necessary to accomplish the program goals.

Partnering should be distinguished from a partnership in the legal sense of the word. A partnership is usually a contractual arrangement in which the partners share an equity (or proprietary) interest in the venture (both profits and risks). A partnership stands in contrast to a procurement contract which involves only a supplier/purchaser relationship, with the supplier having no equity stake in the venture.

D. Cooperative Research and Development Agreements

To spur R&D, to provide incentives to researchers in government laboratories, and to encourage private participation in government funded research, Congress enacted the Federal Technology Transfer Act. This legislation provides a framework for laboratory-industry coordination through Cooperative Research and Development Agreements (CRDA's). Through CRDA's, government and industry can share intellectual property — patents, software, copyrights, etc. — that result from joint research. Laboratories have broad authority to negotiate intellectual property rights to encourage commercialization and technological diffusion. Typically there is protection of trade secrets for 5 year period (Freedom of Information Act exemption). CRDA's allow government laboratory employees to collect royalties on the order of 15 to 20 percent on their research products if a private sector patent results. Typically cost sharing is involved and there may be additional funding from the government sponsor.

According to a study by Amy Polk on technology transfer from military applications to ITS, the trend among national laboratories within the Department of Energy is to form stable partnerships with big name companies in order to develop highly advanced technologies. Major weapons laboratories have formed partnerships with such companies as Motorola, General Motors, DuPont, Hewlett-Packard and National Semiconductor.

As a result of the CRDA's and strong support from the Bush and Clinton Administrations, there has been a large increase in recent years in the number of such cooperative arrangements. In 1992 the U.S. Army alone reported 207 CRDA's which the Army expected to climb to 287 by the end of 1993.[4]

CRDA's are only one means for the private sector and public institutions to share in the fruits of R&D and foster technological diffusion and implementation. Other methods include national laboratories performing commercial work for others, conducting non-commercial work for others with industry partners, entering into memorandums of agreement, licensing of intellectual property, entering into agreements to use each others facilities, and personnel exchanges.

CRDA's provide speed and flexibility in forming deals. However, they are not a procurement contract or a cooperative agreement and therefore do not fall under the Federal Acquisition Regulations.

E. Design-Build-Operate

Pre-deployment can extend through the implementation phase if the public and private entities are responsible not only for the design phase, but also construction/implementation and operation phases. There are many variations on this theme. Rather than discussing them in connection with pre-deployment activities, they are discussed in more detail below regarding alternative deployment models.

4 Amy Polk, "Technology Transfer from Military Application, to Intelligent Vehicle Highway Systems," Surface Transportation: Mobility, Technology and Society, Proceedings of the IVHS America 1993 Annual Meeting, Washington, D.C. April 14-17, 1993, pp. 602-607.

IV. CHAPTER FOUR - DEPLOYMENT MODELS OF PUBLIC/PRIVATE PARTICIPATION

A matrix appears in Table 1 summarizing the implications of different models of public/private participation that are potentially applicable to the deployment of ATMS and ATIS (See Table E-l). These different models, described more fully below, are:

(1) Pure public provision
(2) Public owner-builder
(3) Standard low-bid contracting
(4) Lifecycle contracting
(5) Performance contracting
(6) Public turnkey
(7) Private owner-builder
(8) Private turnkey
(9) Private competition
(10) Public/private competition
(11) Auctions
(12) Yardstick competition
(13) Open solicitation of public/private partnerships
(14) System manager
(15) Cost sharing
(16) Joint ownership
(17) Functional division of responsibilities
(18) Competitive joint venture
(19) Public/private consortium under public agency (intermediary)
(20) Incentive regulation
(21) Public Franchise
(22) Business Franchise
(23) License
(24) Concessions
(25) Leasing
(26) Service provision under government aegis
(27) Monopoly regulation

The matrix shows the involvement of the public and private sector in different stages of the lifecycle of ATMS and ATIS, highlights key economic issues, indicates the adaptability to ATMS or ATIS, and provides an assessment of whether the model would result in low, medium or high speed of deployment for ATMS and ATIS.

Pre-deployment and deployment models of public and/or private involvement are not necessarily mutually exclusive. Some are compatible and some not. Table 2 indicates which ones have at least some degree of compatibility and thus permit mixing and matching.

Most of the remainder of this report elaborates on each of the models of public/private sector participation.

TABLE 1: MODELS OF PUBLIC/PRIVATE PARTICIPATION

ORGANIZATIONAL MODEL	INVOLVEMENT AT STAGES OF LIFE-CYCLE						ECONOMIC ISSUES							ADAPTABILITY		SPEED OF DEPLOYMENT & MARKET PENETRATION	
	Initial Ownership	Design	Build	Operate	Maintain	Final Ownership	Entry	Exit	Economies of Scale	Competition vs Monopoly	Costs & Risks	Consumer Price	Benefits	ATMS	ATIS	ATMS	ATIS
1. Pure Public Provider	Pu	Pu	Pu	Pu	Pu	Pu	R	B		GM	NR,IA	FL	PB	L	L	L	L
2. Public Owner-Builder	Pu	Pu	Pu	Pu,Pr,OPu	Pu,Pr,OPu	Pu,Pr,OPu				GM,CS	NR,LC,IA	FL	PB,PM	L	L	L	L
3. Standard Low Bid Contracting	Pu	Pu,Pr	Pr	Pu,Pr	Pu,Pr	Pu				CC,CS	NR,IA	FL	PB,PM	L-M	L-M	L-M	L-M
4. Lifecycle Contracting	Pu	Pu,Pr	Pr	Pu,Pr	Pu,Pr	Pu				CC,CS	NR,IA	FL	PB,PM	M-H	M-H	M-H	M-H
5. Performance Contracting	Pu	Pu,Pr	Pr	Pu,Pr	Pu,Pr	Pu				CC,CS	NR,IA	FL	PB,PM	M-H	M-H	M-H	M-H
6. Public Turnkey	Pu	Pr, OPu	Pr, OPu	Pu,Pr,OPu	Pu,Pr,OPu	Pu,Pr,OPu				CC,CS	CR,LC	CP	PB,PM	H	M-H	H	H
7. Private Owner-Builder	Pr	Pr	Pr	Pr,Pu,OPr	Pr,Pu,OPr	Pr,Pu,OPr				CC,CS	CR,LC	CP	PM	L	M-H	L	M-H
8. Private Turnkey	Pr	OPr,Pu	OPr,Pu	OPr,Pu	OPr,Pu	Pr,OPr,Pu				CC,CS	CR.LC.RP	CP	PM	L	M-H	L	M-H
9. Private Competition	Pr	Pr	Pr	Pr	Pr	Pr				CC,CS	CR,LC	CP	PM	L	H	L-M	L-H
10. Public/Private Competition	Pu	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr				CC,CS	NR,TC	CP	PB,PM	L	H	L-M	L-H
11. Auctions	Pu	Pr	Pr	Pr	Pr	Pu,Pr	R	B		MP,CC,CS			PM,RS,PB	L-H	L-H	M-H	M-H
12. Yardstick Competition (b)	Pr	Pr	Pr	Pr	Pr	Pr	R	B	J	MP	CR,TC	PR	RG,PB,PM	L	L	L	L
13. Open Solicitation	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr				CC,CS	CR,RR,TC,LC		PM,RS,PB	L-H	L-H	L-H	L-H
14. System Manager	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	R			MP,CC,CS	CR,LC			H	H	M-H	M-H
15. Cost Sharing	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr				AT	CR,RR		PM,PB	H	H	L-H	L-H

Organizational Model
(a) = can be exclusive or non-exclusive
(b) = can be publicly-owned ROW and investor-owned company

Involvement at Stages of Lifecycle
Pu = Public
Pr = Private
OPu = Other Public
OPr = Other Private

Entry
R = Restricted

Exit
B = Barriers

Economies of Scale
J = Justification for Model

Competition vs. Monopoly
GM = Public Monopoly
MP = Monopoly Power
CC = Competition in Construction possible
CS = Competition in Service provision possible
AT = Antitrust can be an issue

Costs and Risks
NR = No cost Recovery if service Pure Public Good
CR = Cost Recovery built-in or can be added
IA = Information Assymetries (i.e. public sector lacks private sector market knowledge)
LC = Lifecycle Cost easily internalized
TC = Transaction Costs high
RR = Risk Reduction for the public and/or private sector
IE = Internalizes Externalities (positive and negative)

Consumer Prices
FL = Free or Low
CP = Competitive Price
PR = Price Regulation

Benefits
PM = Profitable Markets
PB = Public Benefits
RS = Revenue Source can be built in (e g toll collection)
RG = Rate-of-return Regulation

Adaptability and Speed of Deployment
L = Low
M = Medium
H = High

TABLE 1: MODELS OF PUBLIC/PRIVATE PARTICIPATION (Cont.)

ORGANIZATIONAL MODEL	INVOLVEMENT AT STAGES OF LIFE-CYCLE						ECONOMIC ISSUES							ADAPTABILITY		SPEED OF DEPLOYMENT & MARKET PENETRATION	
	Initial Ownership	Design	Build	Operate	Maintain	Final Ownership	Entry	Exit	Economies of Scale	Competition vs. Monopoly	Costs & Risks	Consumer Price	Benefits	ATMS	ATIS	ATMS	ATIS
16. Joint Ownership	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr				AT,MP	CR,RR		PM,PB	L	H	L-M	M-H
17. Funct. Division of Responsibility	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr				AT	CR,RR		PM,PB	L-H	L-H	L-H	L-H
18. Competitive Joint Venture	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr			J	AT,MP	CR,RR,LC,TC	CP	RS,PM,PB	L-H	L-H	L-H	L-H
19. Pub/Priv. Consortium Under Public Agency	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	R	B		AT,MP	CR,RR,LC,TC	PR,CP	RS,RG,PM,PB	M-H	M-H	M-H	M-H
20. Incentive Regulation	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr					TC,IE		PB	L	L	L	L
21. Public Franchise (a), (b)	Pu,Pr	Pu,Pr	Pr	Pr	Pr	Pu,OPu,Pr,Opr	R	B	J	MP,CC,CS	CR,RR,LC	PR	RS,RG,PM,PB	H	L-H	H	L-H
22. Business Franchise	Pr	Pr	Pr	Pr	Pr	Pr	R	B		CC,CS	CR,RR,LC	CP	PM	L	H	L-M	H
23. License (a)	Pu	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	R	B		MP,CC,CS	CR,RR	PR,CP	PM,PB	L-M	L	L-M	L-M
24. Concession (a), (b)	Pu	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,OPu,Pr,OPr	R	B	J	MP,CC,CS	CR,RR,LC	PR	RS,RG,PM,PB	H	L-H	H	L-H
25. Leasing	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	Pu,Pr	R	B		MP	CR	PR,CP	PB,PM	L-H	L-H	L-H	L-H
26. Government Aegis (a), (b)	Pu	Pu,Pr	Pu,Pr	Pr	Pu,Pr	Pu	R	B		MP,CC,CS	CR,RR	RR,CP	RS,RG,PM,PB	L-M	M-H	L	M-H
27. Monopoly Regulation (a), (b)	Pu,Pr	Pu,Pr	Pr	Pr	Pr	Pu,OPu,Pr,OPr	R	B	J	MP,CC,CS	CR	PR	RS,RG,PM,PB	L-M	L	L-M	L

Organizational Model
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Benefits
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PB = Public Benefits
RS = Revenue Source can be built in (e.g toll collection)
RG = Rate-of-return Regulation

Adaptability and Speed of Deployment
L = Low
M = Medium
H = High

A. Pure Public Provision — Single or Multiple Agencies

In the purely public model of provision one or more public agencies owns the property, and also designs, builds, operates and maintains the system. There are roads, for example on public lands, usually unpaved, which have been designed, built, operated and maintained by a governmental agency. Many state departments of transportation design, fabricate, install, inspect, repair, replace, and dispose of signs. These agencies are responsible for signs from cradle to grave. In the ITS arena, there are likely to be instances where a single agency seeks to be responsible for ATMS or ATIS throughout all the deployment stages. For example, the City of Los Angeles Department of Transportation leans toward a purely public approach to the design, deployment, operation, and maintenance of some of its traffic surveillance and signal control systems that will become part of the overall ITS system.

Pure public provision could occur through a single agency,. but that is unlikely in a multijurisdictional environment. A more natural form of public provision of ATMS and ATIS would be a consortium of public agencies working together under some type of agreement that shares cost and responsibilities. Sources of funding for design, purchase of manufactured products and software, and installation of the publicly owned portion of the system may include local, regional, state and federal taxes and user charges, and, once ATMS and ATIS were operational, possibly fees for service as well. Responsibilities for designing, building, operation and maintenance might be parcelled out among agencies along functional lines, or each agency might be partly responsible for every phase of deployment over the system's lifecycle. In-vehicle equipment would, of course be purchased when individuals and firms bought vehicles or add-on equipment.

The pure public agency approach has appeal to some agencies because the roadways are already under their jurisdiction and include the right-of-way for laying of fiber optic cable to serve ATMS functions. One or more agencies in a region may already own and operate a traffic management center and perceive it is a natural extension to design, implement, operate and maintain other features such as the fiber optic system, video cameras, changeable message signs, and highway advisory radio that will serve ATMS.

Public agencies pooling their funds nationally might facilitate a pure public approach to the deployment of ATIS. Numerous states, by pooling their funds under the umbrella of the American Association of State Highway and Transportation Officials are developing software for infrastructure management systems (bridges and construction). AASHTO has contracted with private firms to design and write the software. Software for ATIS could be developed in a similar manner, perhaps with additional sponsorship of members of the National Association of Regional Councils. However, instead of contracting with a private firm, a team or task force of government employees could develop the software for public distribution and deployment. Coordination among software designers and programmers among states would not be easy, and almost certainly would be a high-risk project, since the public sector lacks expertise in telecommunications standards and protocols which must be integrated into the software.

The pure public agency approach bars the private sector from the provision of ATMS and ATIS. An important consequence is the lack of competitive pressure from any quarter to minimize costs and the likelihood that excessive future costs will arise because the public agencies would probably lack expertise to achieve cost savings through a deep understanding of emerging technology and improving business practices. On the other hand, if the public sector does have the expertise, given the relatively low wage scales in government compared to the private sector (as documented in the Urban Institute's study on ITS Education and Staffing Needs), the public sector can provide certain services more inexpensively than the

private sector. For example, the public sector can often perform computer aided design and drafting of roads and bridges at less cost than engineering design firms. Another advantage of purely public provision is that all costs are internalized within the public sector over the entire lifecycle.

Given that ATMS or ATIS would be publicly provided under this model, there would be strong pressure to provide traffic related information at no cost to the consumer. Normally there would be strong reasons to allow the private sector in providing ATIS user services to bundle and sell the traffic data in different forms. However, in the purely public model, the public agency might also package traffic data with other data for delivery to vehicles, homes, businesses, transit kiosks, and so on. Consumers would be likely to pay for telecommunication costs, but otherwise the bundled information would be treated as a public good.

Another possibility is the public agency would provide basic ATIS user services. The rationale for this approach is the private sector could add additional information based upon profitable opportunities. The public agency(s) would not have the resources compared to the private sector to build the wide variety of data bases that could be combined with traffic data in order to satisfy consumer and business appetite for different travel related information. Compared to the private sector, the public sector is ill-equipped to market the information in a way to capture what various market segments are willing to pay and to raise capital based upon marketing studies.

Under this model the speed of deployment of ATMS is likely to be slow, except possibly in some unique situations where a state, region or municipality already has significant investments in a traffic management center, surveillance systems, or advanced signal control systems, and desires to piggyback on these without using the help of the private sector.

Early deployment of ATIS using the purely public approach is also likely to be slower than approaches involving the private sector, although deployment could be accelerated by the application of additional public funds.

B. Public Owner-Builder

This approach offers a number of variations upon the one described above. Here the owner — a public agency or several working under common agreement — designs and builds the system. The owner could also take responsibility for operations and maintenance, in which case the public owner-builder model becomes the same approach as the pure public agency model. However, the agency can also contract either with another public agency or a private firm to carry out the operations and/or maintenance. The final ownership could remain with the public agency, or ownership could switch to another public agency or a private company.

The public owner-builder approach does not lend itself well to either ATMS or ATIS. The public is unlikely to have the resources — the skilled people, equipment and material — to build an ATMS or implement all the components of an ATIS. However, the owner could certainly contract for construction and thereby acquire all the needed skills, equipment and material. But contracting out is a feature of other models discussed below.

Even if the public owner-builder could fully deploy an ATMS, there would be but one provider of ATMS, even though responsibility for operation and maintenance and final ownership might change hands after it is built. Thus ATMS would be a publicly owned monopoly, justified by economies of scale. The

costs would be internalized up until the stage in the lifecycle where responsibility shifts to another public or private firm. It is likely that ATMS user services would be treated as a public good and offered to the public for free. However, users of traffic data might be charged to cover costs. It is also possible that the operator, through its monopoly power, could try to extract all that people and firms were willing to pay through discriminatory pricing of different market segments, but this might be politically unacceptable.

The public sector could design and build ATIS, but as noted above, such a system would most likely be limited and provide only basic service. The private sector would add information and functionality to the basic service, provided the cost of the basic service to the value-added reseller were not so high as to preclude making money.

C. Standard Low-bid Contracting

The most common form of procurement in the highway industry is standard low-bid contracting. Federal law requires award of a construction contract to the bidder offering the lowest construction cost for highway projects involving federal funds. The lowest cost is typically based upon lowest initial construction costs, not lowest lifecycle costs, and thus does not internalize operations and maintenance costs in the bidding process. The public agency typically performs the engineering and develops plans and specifications, perhaps by contracting out the design function, and then solicits the lowest bid from competitors in the private sector to construct the facility. Once the facility has been constructed, normally the responsibility for operation and maintenance remains with the public agency.

Standard low bid contracting can be carried out for ATMS, though other types of contractual and public/private relationships may be better. For example, the Texas Department of Transportation designed the Fort Worth traffic management center, and let it for bid under a standard low bid contracting procedure. The public sector is to carry out the ATMS function once the traffic management center is in place.

Standard low bid contracting seems ill-suited for the deployment of ATIS, since initial development involves the creation of data bases, digital maps, telecommunication linkages, route guidance algorithms, and in-vehicle equipment. These types of products are more commonly developed by the private sector under the stimulus of potential profits. The private sector typically undertakes to develop such systems if the revenue stream over time is greater than the sum of initial costs and future costs after adjusting for the time value of money (i.e. discounting). The private sector therefore seeks a contractual mechanism so as to be able to trade off present and future costs so as to minimize lifecycle costs and internalize all revenues so as to result in the most profitable opportunity possible. Standard low bid contracting cannot do this.

Other types of contracting mechanisms such as low-bid cost-plus contracts, can offset these problems somewhat by shifting some of the risk to the procuring agency. However, such cost-plus contracts reduce the contractor's incentive to be cost-efficient, necessitating rigorous review and enforcement of provisions to prevent cost-padding by the contractor.

Under standard low-bid contracting, ATMS would be a publicly owned and operated monopoly. Competitive provision of other systems with similar capabilities by public or private providers would be unlikely, even in cases where two or more regional traffic centers were established to increase reliability through system redundancy. The public monopoly could price the traffic information any way it saw fit that is politically acceptable. It could be free; there could be a nominal charge; price could equal marginal

costs; or the price could extort the entire amount people and firms are willing to pay through discriminatory pricing. There would be no competition to impose market discipline either to keep costs down, or in the case where traffic data is provided for free, to provide an indication of the true costs of the service. As in the purely public model, the traffic data is most likely to be treated as a public good and the cost to the user of traffic data would most likely be zero in order to maximize public and private benefits.

Even though the ATMS would exist as a public monopoly under this model, there would be cases where private fleet managers and other businesses can reap profits by providing selected traffic surveillance and route guidance information more advantageous to certain users than the public sector can provide. For example, a company with satellite and air traffic surveillance, combined with image processing and pattern recognition, could develop nearly real-time traffic data and use it in conjunction with routing algorithms to provide superior route guidance information to certain markets. Such a service would not have the same scope as a fully developed regional ATMS, whose tentacles spread across a large number of local jurisdictions and which attempts to optimize traffic flow throughout a region.

D. Lifecycle Contracting

In principal, a contract can be awarded to the bidder offering the lowest lifecycle cost. In practice this is a difficult concept to implement, because contracts are typically awarded only for one phase of a project's lifecycle, such as construction. Then the basis of the award — lifecycle costs — must necessarily be different from the basis for payment — say initial construction costs. In practice there are a variety of ways to implement some form of lifecycle contracting. One is to include long-term costs as a bid item. The contracting agency might also adjust the low bid based upon the estimated lifecycle costs. Another approach is to accept alternative bids from each contractor. Each alternative bid would contain design features that are more or less conducive to reducing lifecycle costs. A not unrelated practice is value engineering, the process of developing alternative designs or procedures, typically during the design or construction phase, in which the contractor can share in the cost savings achieved in comparison to the cost of the original design concept.

Lifecycle contracting can apply to design concepts accompanied by either materials and methods specifications or performance specifications. Historically, highway contracting has used material specifications almost entirely as the basis for competitive contracting. In methods specifications contractors bid on each and every bid item where the method of providing a bid item is frequently specified in terms of the materials and test procedures to be used. Performance specifications simply set out the end results or performance to be achieved.

Lifecycle contracting is adaptable to both ATMS and ATIS, and unlike typical bidders on highway projects, most firms in the electronics and telecommunications industries would probably prefer it to standard low-bid contracting. Lifecycle contracting does not have any inherent advantage in speeding deployment of ATMS or ATIS, but it will tend to lower long run costs in comparison to standard low bid contracting (but not as much as a design-build-operate-maintain type of project).

A potential problem with lifecycle contracting is that one cannot always foresee technological change. Contracting procedures involving lifecycle costs must necessarily make explicit or implicit assumptions about future technology that could be off the mark.

Lifecycle contracting is not normally practiced in highway-related procurement, although there is growing interest in the concept. The Federal Highway Administration has set up criteria for bidding pavements using lifecycle costing. Other newer approaches related to lifecycle contracting are discussed in the Transportation Research Board Circular, "Innovative Contracting Practices" prepared by a Transportation Research Board task force.

Lifecycle contracting would most likely be used in situations where a public agency is interested in deploying ATMS or ATIS. However, nothing precludes a private owner from using lifecycle contracting.

E. Performance Contracting

Performance contracting is a method of providing goods or services through a contract awarded based on the ability of a contractor to satisfy performance specifications. The fundamental purpose of performance contracting is to emphasize desired outcomes as opposed to the means for obtaining those outcomes. In procuring electronic equipment and telecommunications, it would be foolhardy to specify to manufacturers how a product should be built, and so performance specifications are nearly always used. Until recently, contracting in the highway construction and paving industry has not seen the wisdom of performance contracting, and as noted above, relies on methods specifications. Similarly, government is often inclined to specify "how" a service is to be delivered, rather than the end results to be achieved. For example, typical contracts for transit service delivery not only specify the route, schedule, and type of vehicles to be used, but also a great many other details including the type of uniform drivers are to wear, and vehicle markings. An alternative approach would be to specify in the contract only the number and type of passengers (e.g. those with disabilities) that need to be moved within a certain time period between certain origins and destinations.

Theoretically, a performance contract leaves the contractor the flexibility to find the best and most efficient method of achieving the performance outcomes specified. This encourages innovation and creativity in finding new equipment and service designs and operational practices, potentially leading to lower costs as well as satisfying the performance specifications.

Performance contracting can be used in conjunction with turnkey and owner-builder projects (see below) that apply to more than one phase of the lifecycle: design, build, operate and maintain. Performance contracting is also useful to elicit innovative ideas for service enhancement once some basic service is already in place. One could permit potential bidders offering to supply an existing service to propose service improvements that would be a part of their bid. The possible service enhancements would depend upon the latitude the contracting agency gives each bidder. If the Request for Proposals (RFP) contains detailed and tightly defined service specifications, there would be little room for innovative proposals. The more latitude the RFP gives, the more likely innovative proposals will be forthcoming.

Performance contracting is compatible with both standard low-bid and lifecycle contracting. Award of a performance contract could be based upon the lowest bid that satisfies performance specifications, including minimization of lifecycle costs.

Performance contracts can also include incentives and penalties. While material specifications still hold sway in highway contracting, incentives and penalties are being included to an increasing degree to speed the work, avoid disruption to users, and reward the contractor for pavement smoothness. Contractors are frequently rewarded for completing a project early and penalized for finishing it late. .

Similarly a contractor may be rewarded for exceeding a pavement smoothness specification and penalized for failing to meet it. Other incentives in the highway industry include incorporation of lane rental fees into contracts and rewards for high quality in certain pay items where an agency perceives a high benefit-cost ratio or significantly lower lifecycle costs. It would seem desirable to be able to include warranties and guarantees related to performance specifications in highway construction and ITS deployment contracts, but federal highway policies state that guarantees and warranties pertain to maintenance and therefore cannot be funded using federal aid for capital projects.

Performance contracting can help speed the deployment of both ATMS and ATIS since it simplifies the process of preparing bid documents and provides potential contractors with a great deal of flexibility in carrying out the work. Performance contracting is well suited to all types of market structure, both monopolistic and competitive. The existence of economies of scale, for example, has a neutral effect on the desirability of performance contracting. However, performance contracting assumes we know what performance we want now and in the future. That is difficult. Performance contracting needs to be able to ensure the construction of an ITS system flexible enough to accommodate future state-of-the art requirements.

F. Public Turnkey

A turnkey project for a public agency that is the initial owner of an ATMS/ATIS involves contracting for one of the following:

(1) Design and build
(2) Design, build and maintain
(3) Design, build, maintain and operate.

In a design-build turnkey project the public owner assumes responsibility for maintenance and or operation and retains ownership once the facility (buildings, software, hardware, surveillance equipment, telecommunications) is constructed/implemented, In a turnkey project that extends through the operation phase, often the facility is turned back over to the public owner for maintenance and operation after sufficient time to allow the contractor to earn a reasonable rate of return on its investment. These type of arrangements are frequently referred to as Build-Operate-Transfer (BOT) projects. However there is no inherent reason why the final ownership and responsibility for maintenance and operation might not change, other than to put a cap on the return on investment. The facility could be sold to the private contractor/operator or to another public agency or private firm.

A related type of turnkey project is build-transfer-operate (BTO). Here the public agency contracts with a private firm to design and construct the facility. Once the facility has been constructed, it is turned over to public agency which operates it.

Public turnkey projects where private sector responsibility extends through the operation phase have become increasingly attractive. These kinds of turnkey projects present opportunities for significant private financing. When a private company can operate a facility and charge for its use, the future revenue stream represents a potential profit opportunity. If the revenue stream is expected to be large and stable enough (e.g. from a toll facility), private capital can usually be attracted for facility design and construction, with the assumption that there would be sufficient revenues in the future to offset maintenance and operating costs and repay with interest any debt or equity capital used to finance the original design and construction. Many toll facilities around the world are now financed in this manner.

Besides the ability to attract capital, another major advantage of public turnkey projects is the internalization of costs if the private contractor not only designs and builds the facility but also operates and maintains it. Internalization of costs creates incentives for cost savings, because the private contractor continually seeks to maximize the difference between revenues and costs over the entire lifecycle.. However, not every firm attempts to minimize costs and maximize revenues. Some firms may merely try to maximize revenues.

From the standpoint of ATMS and ATIS, a public turnkey system introduces a private party into a complex multijurisdiction public arena. The private party may be in a position to mediate among the different jurisdictions and facilitate the introduction of ATMS or ATIS, thus overcoming many traditional and largely jurisdictional barriers to the deployment of complex traffic management systems. This is not to say that a public agency could not serve the role of mediator/facilitator. However, as an independent party and a fresh face, a private firm may be in a better position to do it.

A public turnkey system for ATMS does not necessarily impose barriers to entry into the market by other firms. However, a de facto monopoly is likely to emerge because of the centralized traffic management functions of an ATMS and the need to avoid duplicate purchase of rights-of-way (other than to provide enough redundancy to ensure reliability). Moreover, because of the need for centralized control and to avoid duplicate facilities, the first firm is likely have a significant advantage over any subsequent entrants. Competitive ATMS will be unlikely to emerge, other than through private firms that offer a limited set of specialized ATMS user services (e.g. traffic surveillance for such purposes as fleet management). Exit by a private contractor from an ATMS market would be difficult because the contract would certainly specify the period of performance and probably require replacement of the existing contractor by a responsible party. When a public agency contracts for the design, building, operation and maintenance of an ATMS, the period of performance will be prescribed before responsibility for operation and maintenance would revert to the public owner.

If an ATMS public turnkey project involves toll collection, there needs to be protection against excessive tolls. Without some mechanism to ensure prices are reasonable and fair, private firms could charge whatever the traffic would bear. Typically, the public agency grants a franchise which specifies the toll rates that can be charged and the rate of return on investment. For ATMS user services, where toll collection is not involved, such as traffic surveillance and control, users will perceive the services to be free, although users will most likely pay for ATMS indirectly through motor vehicle fuel and other taxation.

Overall the public turnkey model appears to be quite adaptable to ATMS and offers the potential to significantly speed employment in comparison to many other approaches.

Some parts of ATIS appear to be well-suited to deployment using a public turnkey approach and other parts appear not to be. Roadside telecommunications, assuming wireless telecommunications could not do the job nearly as well, will be essential for real-time route guidance. Beacons may be deployed along roads and thus will be in their rights-of-way. The unique positioning of the beacons might be reason enough to handle their design, installation, maintenance and operation as a public turnkey project.

Other parts of ATIS would not lend themselves so well to this model of public/private sector involvement. Telecommunications infrastructure, data bases, and in-vehicle equipment would probably best be provided in the competitive market place, especially if open architecture standards are in place. The aim would be to achieve the best mix of price, range of services, and quality. Certainly, the public

sector should not try to take primary responsibility for the design and manufacture of in-vehicle navigation and route guidance equipment. There is ample private market incentive for that, as has already been demonstrated by the sale of such equipment in high valued markets such as commercial vehicle operations and public transit, as well as selected automobile buyer markets. In light of the revolution occurring in. the telecommunications industry, it also seems inappropriate for the public sector to install telecommunications infrastructure, except perhaps to lay conduit in certain circumstances and other simple installations. Local and long distance telephone, cable TV and cellular telephone companies as well as computer information services, electric utilities, and others will all be providing parts of the telecommunications infrastructure in urban areas. The deployment of this infrastructure should be left largely to the private sector. The public sector could contract for the design, build, operation and maintenance of ATIS data bases, but the private sector is just as likely to deploy ATIS on its own initiative, except for any roadside infrastructure required. The most that public sector could do is perhaps accelerate the deployment of ATIS using a public turnkey approach, but' before too long competitive market forces are most likely to shape the ATIS services offered. Justification for public involvement would be that the public benefits justify the public involvement when private benefits, namely profits, by themselves are insufficient incentive for the private sector to deploy certain elements of ATIS.

G. Private Owner-builder

This approach has low to moderate applicability to ATMS but moderate to high applicability to ATIS. The usual thinking is that an ATMS will be a publicly owned system and there will be no physical portability of an ATMS from one urban area to another. A traffic management center, surveillance system, and installed traffic control equipment cannot be uprooted and replanted in another city.

Thus it would seem there would be no place for a private firm to design and implement its own ATMS. However, limited privately owned ATMS/ATIS systems, with only a traffic management center, traffic surveillance and route guidance, might be leased and operated, and eventually sold to fleet management and other companies. It is also possible that more complete separate or integrated ATMS and ATIS systems might be mass produced on a small scale by a private firm, leased and installed in a number of urban or metropolitan areas, and continued to be operated or maintained by the private firm or subcontractors, while the ATMS remains under the original private ownership. An analogous type of system is a largely prefabricated small powerplant and localized transmission system (say for a public or private campus) that is leased to a public or private firm. While traffic management centers are being established as unique facilities in the large cities and metropolitan region, it is possible that the private owner-builder model for the deployment of ATMS might be applicable to small cities, say under 250,000 people in population, and could spur rapid deployment.

While deploying ATMS under this type of arrangement would be challenging, some firms are already developing ATIS systems that are portable from one metropolitan area to another. Cookie-cutter systems help achieve economies of scale in design and installation. Cookie-cutter systems may still be monopoly systems in each setting in which they exist, however. ATMS, even if it were a cookie cutter system, is likely to be a monopoly in a particular urban area. ATIS is less likely to evolve as monopoly service since competitors will emerge that provide differentiated services such as digital maps, complementary travel and shipper related data bases, and route guidance.

The private owner/builder approach to deployment is likely to internalize costs over the entire lifecycle. Benefits in the form of profits accruing to private firms are most likely to materialize. It is difficult, however, for a purely private unregulated provider to capture all the public benefits of ATMS

and in the form of private profits, thus leading to under-provision of service. Consequently some public benefits such as reduced congestion, air pollution, and accidents would accrue where such systems were developed, but public benefits of ATMS deployed under the private owner-builder model are likely to be less than many other approaches to public/private participation. Public benefits of an ATIS developed under the private owner-builder model are more likely to be on a par with other models effective for ATIS deployment.

H. Private Turnkey

A private turnkey project results when a private company is the owner of facilities, equipment, etc. and contracts with another organization — it could be private or public — to design, build and perhaps in addition operate and maintain an ATMS, ATIS, or related user service. Strictly speaking, a private turnkey project is unlikely to be relevant to the deployment of a regional ATMS system. The private company does not own the roads to be managed, the needed rights-of-way for system development, and most likely will not own the land or buildings which are to be the site of a traffic management center. Even so, this model of public/private participation might apply to ATMS in rare cases. For example, it might apply if a public agency were to sell to a private company the following:

(1) the rights-of-way to install fiber optic, other telecommunications infrastructure, and traffic surveillance and control equipment;

(2) the land and buildings for a traffic management center if the private sector did not purchase them from another source.

In addition, the public agency(s) would have to grant the responsibility for the management of the roadway system to the private sector, assuming it has the legal authority to do so.

Then the private company might contract with one or more other private or public organizations to design, build, operate and maintain the ATMS. If this were to occur, the private owner and contractor(s) would amount to a monopolist. The need for centralized management and the economies of scale associated with avoiding duplicative rights-of-way would serve as barriers to entry giving rise to monopoly power. No other firm could easily enter the market. Also, the terms of the sale from the public agency to the private owner would probably prohibit the private owner and its contractor(s) from abandoning the system without finding a responsible party to take it over.

It is easier to envision a private turnkey project for ATIS. Imagine a group of investors or a company in possession of an asset fundamental to ATIS, such as a travel related database software or digital maps. This group of investors or company might wish to deploy an ATIS user service by contracting with another private company to design, build, operate and maintain it, provided the revenue earned from the user service exceeded the cost of contracting. This is not a far-fetched arrangement nor is it uncommon within the private sector. Moreover, within any one market, there could more than one instance of this arrangement occurring, which helps create a competitive environment.

Under the private turnkey model, to the extent that a single firm is responsible for all phases of deployment, there would be strong incentives to internalize costs and garner benefits in terms of profits. The magnitude of public benefits that would result might be just as large as many other models of public/private involvement, but only if all the public benefits could be captured through private profits. Consumer prices for monopoly ATMS services might be high without compensating protection, but in the

case of competitive ATIS services, the marketplace would probably provide the needed discipline to control costs and spur product differentiation.

I. Private Competition

Another possibility for ATMS/ATIS deployment is the model of pure private competition. The public sector leaves all aspects of deployment to the private sector to occur within a competitive environment. Government's role would be solely to enforce antitrust laws and ensure there are sufficient competitors to drive costs and prices to levels consistent with significant competition.

Pure private competition has great appeal for a mature, rapidly evolving industry, where technological innovation is essential to remain competitive and viable. Competition is also desirable during the initial deployment stage, but the difficulty and risk in recovering large initial costs in the presence of economies of scale and the importance of avoiding destructive competition that occurred in the early years of other industries (electric power, mass transit, railroads) may make pure private competition unworkable at the outset. Destructive competition can drive all but one firm out of business if the industry has strong natural monopoly characteristics of rapidly declining average cost. The firm producing the greatest level of output will have lower average costs than its competitors and can continually expand its scale of operations so its costs and prices continue to decline relative to the competition. In these situations, usually antitrust enforcement and regulation can temper destructive competition.

If private competition were sufficient for ATMS/ATIS deployment, the correct policy would be to do nothing and wait for the desired products and services to emerge. The reality with regard to ATMS is that many of the services that flow from it have public good characteristics and it is difficult to exclude users. In such a market, a private competitive, laissez-faire approach is unlikely to bring about deployment.

J. Public/Private Competition

In this model of public/private participation, the public agency is the initial owner and competes with the private sector for provision of services. An administrative arm of the agency manages the contracting process, and awards a contract to another unit in the agency or to a private firm under a competitive bidding process. It is also possible for another public agency to manage the contracting process. For example, a design for an ATIS might be developed along with performance specifications for operation and maintenance (the design and specifications could be prepared by the public agency or by a private firm). Then a relevant unit of the public agency would compete with private firms to build, install, operate and maintain the system.

In general, public/private competition is unlikely to result in the full deployment of ATMS and ATIS because most public agencies lack the expertise to build, operate and maintain these systems. However, in those cases where the public agency does have the expertise to operate and maintain the system, the public sector might compete with the private sector for the maintenance and/or operation of a system once it is built.

It has become common in England and Australia to require the maintenance staff within a transportation agency to compete with the private sector for a maintenance contract. This practice imposes the discipline of the market place on not only the private sector but also the public sector. The practice

also helps to answer the common question of whether it is more cost-effective for a government agency to perform work using its own staff or to contract for services. Implementing a procedure for public/private competition is not easy since it requires two essential things:

(1) An independent governmental unit (either within the public agency or in another one) to administer the contracting process;
(2) Establishment of cost accounting procedures to ensure that public agency costs are comparable with private sector costs. Public/private competition is unworkable if the private sector bids on the basis of total (i.e. fully allocated costs) while the public sector bids on the basis of variable (marginal) costs.

If public/private competition only occurs for selected stages of the lifecycle (i.e. operations or maintenance), then costs over the lifecycle may not be internalized, a shortcoming of this approach.

Consumers are likely to benefit from public/private competition because the consumer price is likely to be lower than it would be without this type of competition, although pure private competition may be equally effective in holding down costs.

There does not seem to be any special reason why more benefits would accrue to either the private or public sector under this public/private sector arrangement in comparison to others.

K. Auctions

Auctions are a method of selling through a process of competitive bidding an exclusive or partially exclusive right to occupy, use or have access to public property. Auctions can also be used to sell public or private property. Some key characteristics of auctions are:

- They can attract significant investment capital if the rights being sold are sufficiently valuable on account of future market opportunities.
- They can be used to sell franchises, concessions and licenses.
- Auctions can be used to regulate the degree of monopoly and competition by controlling the number of franchises, licenses, etc. to be sold.
- The ability to attract investment capital depends on the degree of exclusivity offered in the market.
- Auctions can be a significant source of public sector revenue.
- Auctions can place a value (price) on the use of public property when previously no such price existed.

Auctions are being used with increasing frequency to sell rights to exclusive or partially exclusive markets. For example the Federal Communications Commission is auctioning licenses for Personal Communications Services (PCS).

Auctions could be used to sell the rights to develop ATIS or ATIS in combination with ATMS provided there is sufficient market value in selling services to attract bidders. Auctions cannot be used to market ATMS alone since ATMS user services typically do not generate any revenue. An exception would be if ATMS included electronic toll collection.

However real time traffic data generated by ATMS does have market value and a public agency could auction off the rights to package the traffic data and sell it to the general public, businesses, and other value added resellers. If the amount of revenue from the sale of traveler information were sufficiently great, earnings could cover the costs of ATIS deployment and possibly even a part of implementing ATMS. In exceptional circumstances where there is strong willingness of the traveling public to pay for traveler information, it might be possible to auction off the rights to deploy both ATMS and ATIS under an exclusive franchise agreement.

L. Yardstick Competition

A variant on public/private competition is "yardstick" competition, as found in the electric utility industry. Yardstick competition does not pit a public and private provider against one-another in a market, but uses public agency performance and costs characteristics as benchmarks that could be applied during the regulatory process governing private utilities. In the past, some state regulatory commissions encouraged "yardstick" competition. Regulatory commissions have used these benchmarks to help establish rates charged to consumers, determine the allowable components in the rate base and set the rate-of-return to the private investors that own the private utility. Private industry frequently challenged regulators regarding the applicability of the cost structure of public utilities in making regulatory decisions regarding private utilities.

One could envision that a public agency that has franchised an ATMS or ATIS might require that some form of "yardstick competition" be used as a basis for setting and periodically reviewing consumer rates including tolls and the allowable rate-of-return to private investors. These might be reasonable criteria in some circumstances for ensuring fair and publicly acceptable consumer prices and making sure profits are not excessive. However, in general yardstick competition seems neither highly adaptable to ATMS or ATIS, nor is it likely to speed deployment. The main reason is that, unlikely the electric utility industry, there is little in the way of effective yardsticks to use.

M. Open Solicitation for Public/Private Partnerships

A number of states — California, Washington, Minnesota, and Virginia, — have recently enacted innovative legislation that sets up a process where private firms can submit innovative proposals to the state to completely or partly finance transportation facilities, and then construct and operate them. The states in certain instances can cover part of the costs, or use their own funds to help leverage private capital. Only projects expected to generate significant revenues, such as toll road projects, are assumed to be viable.

The State of Washington's legislation has the following features:

- Authorizes and encourages the Secretary of Transportation to explore the feasibility of constructing privately financed transportation systems and facilities by using innovative agreements with the private sector.

- Permits the Secretary of Transportation to solicit, evaluate, negotiate and administer public/private agreements pertaining to planning and design, construction, upgrading, or reconstruction of transportation systems and facilities.

- Allows the transportation department to take advantage of federal programs fostering public/private partnerships.

- Permits the public and private sector to conceive and pick projects at their discretion,

- Authorizes $25 million in long-term bonds and establishes a loan account in the transportation fund.

The general framework for agreements between Washington State and a private partner was also set out in the legislation:

- Developer Rights: Developer does not have the right to build and operate a transportation facility but an opportunity to study, design, and finance it. If the private entity can attract the capital, then they have the right to carry out the project.

- Ownership: Provides for initial ownership during construction and then the sale to the state whereupon the developer leases it back for up to fifty years in order to operate it, with the private sector assuming the risk as to whether revenues will cover investment costs and profits.

- State Services: The state will provide services necessary for the execution of the project but the developer must reimburse the state for the costs.

- State Standards: The project must comply with state highway standards and laws governing operation and use of the facilities.

- Performance Schedule: The developer must adhere to all the milestones in the project development schedule.

- Authorities: The state has the authority to lease facilities, right-of-way, airspace, exercise its power of eminent domain and grant easements, permits, real property rights, etc.

- Protection from Competition: Agreements may protect the developer's project from competition as long as the public agencies are not unreasonably inhibited or prohibited from developing additional transportation facilities.

- Liabilities: Risk is allocated among the state and the private developer so that liabilities are substantially less than if the state were to develop the project by itself.

- Financing: Agreements may include many provisions to enable the capital to be developed for the project. These include economic remedies for interfering with developer's rights, lender protections, state financial participation, maximum return on investment,incentive rates of return, the ability to adjust toll rates and user fees if the rate of return on investment is unaffected, and the requirement that expenditures from the revolving loan fund be approved by the legislature.

Washington State has already completed a cycle of proposal submissions, evaluation and selection under this public/private partnership arrangement. Teams formed to explore various project possibilities and public/private partnership arrangements. Twenty four projects were explored, and 14 proposals were submitted. Technical review by over 60 personnel occurred, and the Transportation Commission approved. six, mainly involving toll projects, for development. The toll projects have proved to be controversial and for the most part have not been implemented.[5]

This approach is related to program development as much as to project development, since it involves more than a single project. It creates significant incentives to unleash the creativity of the private sector — or for that matter any entity, public or private — to identify and propose potentially feasible solutions to transportation problems. Moreover, it holds the promise of significantly leveraging scarce public funds through creative financial arrangements that could exploit equity capital, public or private debt, value capture of real estate appreciation, leasing, etc.

This process could apply to ATMS and ATIS projects just as much as it might apply to the highway construction and other projects proposed in response to the State of Washington's solicitation. It would tend to speed up implementation for those projects proposed and funded, because only those projects considered most feasible and expeditious are likely to be approved, unless, of course, those issuing project approvals were unrealistic about the political, economic, environmental, or technical feasibility of the projects.

The most significant danger of this approach is that projects involving public-private partnerships and funded under such a program as Washington's might have different priority than projects funded and programmed in the traditional manner. The requirement under ISTEA that each state and metropolitan planning organization include all types of projects in the Transportation Improvement Program will help mitigate this difficulty, since agencies are forced to sort out priorities within the programming process.

N. System Manager

Program and system managers were discussed above in connection with pre-deployment. Typically when an organization has program management responsibilities tied to a particular system, such as a regional ATMS/ATIS, the program manager is often referred to as a system manager. Under this arrangement the system manager becomes the responsible entity. The system manager could be a public agency, but often the government selects a private contractor. Typical responsibilities of a system manager include refining requirements and specifications, preliminary design, preparation of standard bid documents, supervision, and inspection of construction, testing and acceptance, systems integration, and operations support.

The system manager concept has the advantage of establishing very clear responsibility for implementation. If a highly effective system manager has been selected, the speed of deployment will be enhanced. The main disadvantage is the concentration of power and the potential lack of diversity of views and inputs at the highest management levels, although there are many ways to incorporate additional perspectives and checks and balances. These include having an advisory committee, a steering committee or a contractor provide quality control, oversight, review and feedback.

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5 Washington State Department of Transportation, "Public Private Initiatives in Transportation, New Partners."

Appendix C provides a case study of the use of a system manager to deploy a warning system for poor visibility in the State of Utah.

0. Cost Sharing .

The public and private sectors might agree to an arrangement or formula to share in the cost of deploying ATMS and ATIS. Cost sharing is common in many specific projects where there is both public and private support. For instance a land developer may be given zoning approval to build a tract of housing, but the agreement may require the developer to share in the costs of meeting local transportation needs either by building new roads or enhancing mass transit. In the housing sector, the government might provide subsidies to build low-cost housing, but the private sector provides the balance of the financing and undertakes the construction.

Ways the public sector can generate its share of costs are found in the literature on public finance and include:

(1) Direct payments. Each unit of government agrees to pay a certain share of costs in dollars. The sum of these contributions is the public share of costs in the public/private cost sharing agreement.

(2) User charges. Government imposes and collects user charges, such as the gas tax or marginal cost pricing. From these user charges the government provides its share of costs to the public/private partnership.

(3) Indirect Payments. Various units of government contribute their share through such indirect payments as subsidies to users or the private sector. One example of a subsidy would be a payment to a firm in a declining cost industry in order to make up the difference between revenue earned based upon marginal cost and the price that must be charged for cost recovery, average cost. Another example would be to provide user-side subsidies, as is often done to lower the price to people with disabilities and other specialized needs who depend upon paratransit. A third example, is to provide favorable tax treatment to private firms providing a publicly desirable product or service, thus forgoing government tax revenue.

(4) In-kind contributions. The government can offer its share in the form non-monetary contributions of property, equipment, rights-of-way, etc. necessary for deployment.

(5) Public Borrowing. The government can use debt financing to pay its share of the project. Thus the government contribution would come from borrowed funds that it must repay at a later date.

(6) Ceding rights to vet-to-exist property. The government could cede rights to something of value that will be produced as a result of deployment, but which does not exist yet, such as intellectual property rights for software and patents.

Ways that the private sector can generate its share of costs are as follows:

(1) Direct payments. Each private firm makes an initial direct contribution to the overall costs based upon a mutually acceptable cost allocation formula. If there is but one private firm, then there is only one private contribution to overall costs.

(2) Revenue sharing. Rather than making an up-front contribution to overall costs, the private sector agrees to meet its cost sharing obligations over time by contributing a fraction of future revenues earned from the sale of goods and services to the overall cost of the project. In some cases the private sector can also share revenue earned from leasing equipment or other private property.

(3) Corporate finance. The private sector can use a variety of corporate finance strategies to meet its cost sharing obligation without having to make initial direct payments at the outset or dedicate a fraction of future revenues. Instead, it can generate funds through private borrowing or equity financing. Thus the private contribution would either come from borrowed funds that it must repay later or from equity capital of owners who expect to earn a reasonable return in the future from their investment.

(4) Inkind-payments. The private sector can offer its share of costs by providing equipment, software, telecommunications and other services of value necessary for deployment.

(5) Ceding rights to yet-to-exist property. Just as the public sector can cede rights to intellectual property and other valuable assets that might arise through deployment, so can the private sector.

A major issue related to cost sharing is the basis upon which costs are to be allocated. There is no single or simple formula for allocating costs, but there are a number of principles useful in practice. These are :

(1) Allocation by Benefits: Under this principle, cost sharing responsibilities are allocated according to the benefits received by the public sector (reduction in congestion, accidents, pollution and energy consumption) and the private sector (profits). In many applications, cost allocation by the benefit principle is extremely difficult to apply. However, in the case of ATMS and ATIS deployment, it seems more sensible and feasible than other approaches.

(2) Allocation by Marginal User Costs: Costs would be allocated in accordance with the marginal costs generated by users, including both internal and external costs. Cost allocation principles found in the highway cost allocation literature are based on variants of this concept (incremental method; the "federal method," marginal social costs, weight-distance tax). This cost allocation principle makes sense from the standpoint of cost recovery only if public and private costs of deployment can be passed onto transportation users. Marginal cost pricing and cost recovery are likely to be compatible only when traffic is heavy enough.

(3) Allocation by Functional Division of Responsibility: The public and private sectors would bear costs according to their functional responsibilities in overall deployment (e.g. design, build, operations, and maintenance — see below for further discussion). This approach is a simple expedient but does not have the same economic justification of allocating costs by benefits or marginal user costs. Note that a participant playing a role that is small but critical to deployment could receive benefits disproportionate to its contribution

The cost sharing issue could pertain to either the total cost of deployment or marginal costs. Normally the total cost is at issue because initial investment costs plus operating and maintenance costs are necessary to deploy the system. Marginal costs consist of just operating and maintenance costs. There will, however, be certain circumstances when initial investment costs are negligible, and most costs are operating and maintenance costs. This may occur when there are already large sunk costs in facilities, rights-of-way, equipment, software, hardware, and telecommunications for ATMS/ATIS and only a small additional investment is necessary to make the system operational.

Cost sharing will significantly speed deployment of ATMS and ATIS in comparison to no cost sharing between the public and private sectors. Cost sharing helps compensate for risk, and can make actions financially feasible that otherwise would be difficult or impossible without cost sharing.

Cost sharing can also be part of other public/private sector arrangements. Cost sharing, for instance, is an integral part of competitive joint ventures and can be made a part of design-build-operate-maintain projects.

P. Joint Ownership

One or more private organizations and one or more public agencies could jointly own a facility or a system such as ATMS or ATIS. There are many legal arrangements that would support joint ownership including legal partnerships and non-profit and for-profit corporations. Ownership confers on the property owners certain rights that do not accrue if only cost sharing is involved. These rights include the ability to sell or lease the property, to grant access or use of the property, and to earn a share of the profits from operation, sale of services, or proprietary spin-off technologies and applications. Different types of ownership structures also have very different tax advantages and disadvantages to both the private and public sectors. Tax savings that would accrue to the private sector usually imply corresponding revenue losses for the public sector.

As a practical matter, the scope of ownership rights of the various owners can be defined in the partnership agreement or articles of incorporation creating the joint ownership entity. As a result, this approach has some flexibility. It is also important to note that this alternative is not mutually exclusive with others listed here, but could be viewed as a vehicle to carry out some of the other structures discussed. The “competitive joint venture” arrangement is a good example. So are the “functional division of responsibilities” and the “competitive public/private partnership solicitation” alternatives.

At the same time, any joint ownership arrangement raises complex legal and policy questions that would have to be addressed, the resolution of which could vary considerably from jurisdiction to jurisdiction based on local or state law. For instance, a local or regional public agency’s legal authority to enter into such a joint ownership arrangement will likely vary from state to state. Moreover, the ability of a such a joint ownership entity to secure the financing benefits of issuing tax-free debt will raise complex tax issues.

Finally, separate and apart from legal issues, permitting private partners to enter into joint ownership arrangements raises significant policy issues. As a practical matter, ownership interest will likely confer on the owner significant benefits and property interests, that due to constitutional constraints, the government will be hard-pressed to alter later on by statutory or regulatory amendments. That means if experience proves that the private owners received too favorable treatment, it will be difficult to correct or make adjustments for that error later on. In addition, there is danger that the private parties chosen to

participate in the joint ownership arrangement will have significant competitive advantages over any other subsequent private entrants into the market (say, for enhanced ATIS services).

Q. Functional Division of Responsibilities

Under this framework, the public and private sectors would each deploy certain functional elements of ITS. For example, the public sector could deploy ATMS while the private sector would deploy ATIS. Another possibility would be for the public sector to be responsible for design, the private sector for construction, and the public sector for maintenance and operation as in standard low bid contracting. Another possibility is offered by the electric utility industry, which distinguishes between generation, transmission, and distribution. One might make analogous distinctions within an ATIS, for example generation of real time traffic congestion data by various monitoring and surveillance technologies (e.g. loop detectors, CCTV, RFID, aerial reconnaissance); generation and distribution of data other than real time traffic information; processing and transmission of data to distributors (e.g. cable TV, cellular); and final distribution or dissemination to homes, businesses, and people on the move. Data generation and transmission of real-time traffic data for an ATIS might be a public agency's responsibility, while the private sectors responsibility might consist of data generation and transmission of non-traffic data and final distribution to homes, businesses and people on the move of all kinds of information.

Different functional divisions of responsibility have different implications for speed and of deployment. Suppose, for instance, the responsibility for the production element ATMS were the public sector's, while the responsibility for transmission and distribution were the private sector's. If the public sector could not overcome barriers to cooperation among different governmental jurisdictions, the speed of deployment might be slow in comparison to an arrangement where the private sector had responsibility for production, transmission, and distribution.

R. Competitive Joint Venture

One option for participation by both the public and private sectors is an innovative and flexible ownership structure called a "competitive joint venture". Competitive joint ventures (CJV's) were developed as a means of dealing with natural monopolies, including electricity transmission, natural gas pipelines, and selected transportation network systems. These industries are usually regulated or publicly owned, due to the existence of extreme economies of scale in the capacity to produce services.

The idea behind a CJV is to *create a market within the facility* in which the capacity to produce exhibits decreasing average cost. While preserving a single plant or set of facilities, so that production costs are minimized, a CJV has several owners who market output independently and competitively. It also has an open entry rule that allows anyone to expand output through investment in the facility. Put simply, a CJV facilitates competition in both short run supply and long run investment.

In a CJV, each owner contributes some share of the cost of the facility and in return receives the rights to the output from that share of the capacity of the facility. Each owner is required to independently dispose of the output from its capacity in competition with other owners. A central operator, which takes production orders from the individual owners, may be publicly owned or monitored by a regulatory agency. The operator is structured as a cost center, not a profit center: it sets no prices and collects no sales revenues. It merely makes use of the facilities as directed by the individual owners and then bills the owners for the costs incurred. Enforcement of the independent marketing rule will tend to drive the price for output to the competitive price.

Whether or not this market is profitable, and the magnitude of profits, will be determined by the amount of output produced by the capacity in place. In the long run, then, anyone is allowed to become an owner or expand ownership by investing in additional capacity. Enforcement of such an open ownership rule would encourage investment up to the point where a normal rate of return is earned by each owner in the long run.

Although CJV's are still in the theoretical stage, various aspects of them are employed today and can serve to illustrate the benefits. Shopping malls are a well-known example of independent marketers sharing the fixed cost of a productive facility. Although rights to use the facility are generally provided through lease contracts, there is no reason why the rights could not be tied to ownership and the responsibility to pay all of the fixed costs of a share of the facility rather than only the year-to-year costs.

Another example is the tradition in the newspaper business of sharing a printing press between two or more newspapers. Production of morning and afternoon papers makes use of the press at different times of day and, if each were to purchase its own press, it would be idle for a good part of the day. The sharing of the cost of a printing press allows each newspaper to produce papers at lower cost than if it were the sole owner, but competition between firms in the marketing of the newspapers can be maintained. The benefits of a CJV structure include a market orientation; price, output, and quality (or packaging) flexibility; no regulation of price, output, or quality; and speedy deployment due to aggressive marketing by competing sellers.

The applicability of CJV to either ATMS or ATIS is dependent upon two conditions. The first is that ATMS or ATIS actually exhibits declining average costs, which is due to economies of scale. In the case of ATMS, the need to avoid duplicative rights-of-way and the requirement for a traffic management center, which is generally thought to require consolidation of all traffic related data at the site of the traffic manager, satisfies the criterion of economies of scale and therefore declining average cost. In the case of ATIS, the criterion of economies of scale would be satisfied if a centralized database were required. Generally, a centralized database for ATIS seems to be the lowest cost solution, although as the communications revolution proceeds, distributed processing may eventually permit data to be combined from disparate data bases at even lower costs. To the extent that a centralized data base is the least cost architecture for ATIS, it will exhibit some economies of scale, and therefore also satisfy the first criterion, although not as well as ATMS.

The second criterion is that capacity must be constrained. The capacity of the facility is generally limited through technological constraints on the ability to produce output. In some instances it may be possible to increase capacity continuously over the long run such that the long term average cost is continuously declining. However, capacity is often "lumpy," so that while it may be possible to continuously increase capacity at declining average costs, eventually a point will be reached where further increase in capacity requires a large lump sum investment and puts the CJV on a new higher short run declining cost curve. As a result, one cannot choose capacity in such a way that demand (at a price equal to average cost) will equal capacity. For any anticipated package of services to be produced by the CJV, the demand for a package of information falls far short of the maximum quantity to be produced, unless the service is priced at a loss. If investors are to recover their costs in the long run, an artificial constraint must be imposed on the quantity to be produced, so that the competitive price for output will rise above the short run marginal cost. In ITS, quantity is of two forms — the quantity used by those with access and the number of people with access. Either one may, in theory, be artificially limited.

The *quantity* used by those with access can be restricted in two ways: set limits on the amount of times a given bundle of information will be supplied, or set limits on the quantity of information within the bundle. Once it has been determined that a particular bundle of information is to be supplied, it is hard to see in practice how to limit the quantity of bundles of information consumed except through some. type of peak pricing on the information highway when the quantity demanded is greater than the quantity allowed. To invoke congestion pricing for information retrieval, usage would have to be monitored, and prices charged that vary with congestion on the system. But it may well be too costly to charge a price for such use of the CJV output — the transaction costs of monitoring usage could be prohibitive.

The alternative way to limit the quantity used by those with access is to restrict the amount of information within the bundle. This might be done by distinguishing between a basic service and value-added services. The CJV might provide basic service to individual travelers for free or at marginal cost, but sell basic service data to value-added sellers at an average price high enough to cover implementation costs.

The other option for limiting use is to obtain long run revenues through rental of access rights. Unlimited use would then be given free to those with access. As long as there is an "access gate," the consumer needs to possess hardware or a code number in order to obtain services; charging for services then becomes feasible.

The CJV structure would be most useful at those stages of ITS deployment that would otherwise be monopolistic due to elements of natural monopoly. Suppose an ATIS were structured as a CJV. Each owner would contribute some amount to the fixed costs of the right-of-way infrastructure if required (e.g. beacons for real-time traffic data) and the Information Processing Center (IPC) (the amount and type of information to be gathered could be jointly decided by the owners, perhaps subject to government approval). In return, each owner would have the right to market services produced by the IPC to consumers.

Cost recovery by the IPC would be through charges levied on individual users either per unit of system use (if this could be monitored at reasonable cost) or through a fixed fee per user. If monitoring of usage is prohibitively expensive, the fee may have to be a one-time (or period rental) fee paid in order to obtain access to the system, whether access is achieved through possession of hardware equipment or through use of a code number.

Under a competitive joint venture there are several possible roles for the government. First there is an inevitable regulatory function that mainly entails enforcement of the antitrust rules governing the CJV. Second government may provide inputs to the CJV. Third, government may wish to consume the output of the CJV, and related to this, may wish to hold an ownership share. More specifically the various roles of government are as follows:

Government as Rule-Enforcer: It is crucial that a CJV be under control of the government in terms of abiding by antitrust laws and the rules governing the joint venture. Failure to enforce independent marketing or open entry in the CJV will drastically reduce the benefits of a CJV as compared with an unrestricted monopolist marketer.

Government as Input-Provider: There are at least two stages at which government may need to provide inputs into the ITS. First, there may be certain resources — land, rights-of-way, etc. — that are held by government and are absolutely necessary for ATIS and ATMS provision. Second,

government may provide information to the entity providing basic service (e.g. the information processing center IPC) and thereby play an on-going role in the market for ITS services. In either case the inputs provided by the public sector may be available at zero cost or at positive cost. A positive price will be the result of bargaining between the government provider and the CJV. owners. Alternatively, government may wish to subsidize the CJV somewhat by providing inputs for free. The rationale for subsidization comes from the public goods nature of ITS — its effect on reduced congestion on roads and highways. Society as a whole (and future generations) will make more efficient use of existing infrastructure and the need for new expenditure will be reduced.

Government as User/Purchaser: The services provided by ITS, and particularly ATMS, may be of tremendous value to local governments. Management of traffic for the efficient movement of emergency and police vehicles or for minimizing the potential danger to motorists in the event of an accident that involves explosives are examples of the demand for ATMS by government.

Government as Owner: The possibility that some government agency would be a consumer of the services provided by ATMS leads directly to consideration of government as an owner of the CJV. As an owner, the government user may have a say in the types of services provided and will have access to these services at average cost.

1. A CJV in a Multijurisdictional Environment

The benefits of a competitive joint venture structure can be obtained even if ATMS is wholly owned by the public sector. To see this, consider the following structure for ATMS and ATIS investment and operation (See Figure 2).

Since local jurisdictions have control over rights of way, they must jointly invest in and use the services of ATMS. Thus, the jurisdictions within a given metropolitan area would share the cost of gathering information for the purpose of public uses for ATMS. One question that would need to be answered by each metropolitan area with more than one local jurisdiction is how the costs will be shared -- proportional to population? tax base? miles of road?

Those uses for the ATMS data base for which individual consumers would be willing to pay and for which government has no objection to private use would be made available to the private sector. That is, at least part of the data base would be provided, either for free or for a fee, to a potential reseller (or resellers). The choice between free provision and provision for a fee depends on fiscal constraints as well as on the trade-off between possible reductions in social welfare due to lower use of the ATMS data base and those due to taxation to cover the cost of ATMS. This is further discussed below.

Once some part of the ATMS data base is provided to the private sector, the private sector can bundle the information from this data base with that from other sources -- parking information, electronic yellow pages, etc. -- and market the basic ATIS (which comes from the ATMS data base) and supplemental ATIS data to individual consumers.

This is where the CJV structure is useful. If this private marketer were a monopolist, then the metropolitan area would be forced either to accept the higher prices that the seller would wish to charge or to regulate the monopolist in some manner or other which could also have drawbacks in terms of high prices or high costs (and thus, high prices). If, on the other hand, access to the ATMS data base is simply sold to anyone who wants to market it, then the lower costs from achievement of economies of scale in

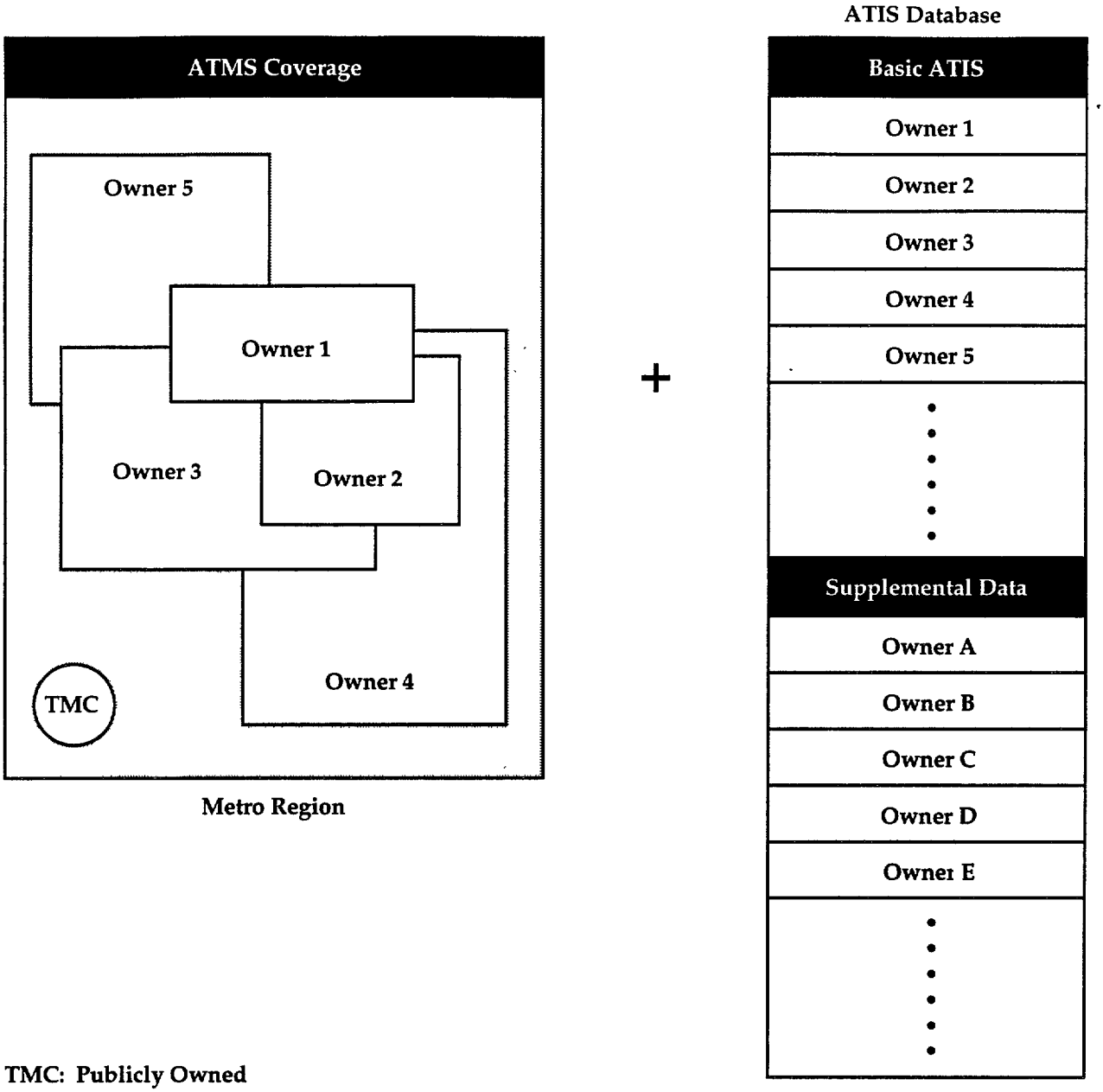

Figure 2. Competitive Joint Venture

centralized data management are lost.

Alternatively, the private seller(s) can be organized as a competitive joint venture, with the cost of investment in data collection and certain hardware shared among several investors who independently market the information services to consumers. The local jurisdictions that own the ATMS data base may become owners in the competitive joint venture, but there is no necessity for that -- they are like anyone else to whom entry into ownership is open.

Investment in the competitive joint venture to market ATIS would operate as follows. Initially, a total number of available customer accounts (for access to the system) is tentatively set and the cost of providing a given set of information to this number of customers is estimated. Anyone may participate in the venture by agreeing to pay the average cost per customer for each account desired. If the total number of accounts desired by investors falls short of the total number initially set, then the total number is reduced, the cost estimate per account is revised and the subscription to accounts starts over. If investors wish to hold more accounts than the number initially set, then the number is increased, average cost is recalculated, and new subscriptions are taken. This process continues until an equilibrium average cost is reached in which investors wish to hold the same number of accounts at that cost per account as can be provided at that cost.

For an investor wishing to hold rights to 100 accounts, its cost of participation is 100 times the equilibrium average cost per account. It may be that the rules would allow an owner to contribute information in kind to the system as a substitute for some amount of cash payment. Note that, if information going into the ATIS data base is to be purchased from non-owners, then some agreement must be reached between the potential investors and the non-owner sellers as to the price of this information so that this cost can be allocated among the owners. If the owners are allowed to contribute information gathering services, then some agreement must be reached as to the value of this information in reducing that owner's responsibility for payment.

Now each owner may proceed to market the accounts that it has rights to. Clearly, each owner is marketing these access rights in competition with the other owners, and thus the market price for consumer access to the system is competitively-induced and presumed to approach the average system cost, including a normal rate of return.

Over time, should outsiders wish to hold additional rights to accounts (or should existing owners wish to expand), this would be accommodated through a revision of the total available accounts and associated cost per account. Existing owners would receive a windfall gain on the accounts they already hold, since the expansion of accounts would reduce average cost in the absence of additional necessary investment. Where additional investment is necessary in order to expand output (the number of accounts), those desiring the expansion would have to pay its full cost and the rules here would be analogous to those that applied during the initial determination of capacity and cost. In general, the average cost responsibility for expansions would be the greater of the average incremental cost of the expansion and the new overall average cost.

Note that the degree of exclusivity of the CJV can be limited at the outset in order to attract capital investment and then relaxed overtime. In other words, rather than begin with an open entry model, participation in the CJV might be limited to two or three owners. The right to become an owner could be granted in a number of ways, through contracting, by auction or other means. After some period of

time, after the market has matured and can support more competition. the CJV can be opened up to more investors/marketers.

2. Financing of ATMS

The ATMS used by the local jurisdictions for public purposes must be paid for in one or a combination of two ways: tax revenues and fees charged for information provided to the private sector. The choice between these two could be made by individual metropolitan areas, but should be made with the following considerations in mind.

Once a given piece of information has been collected, and the lump cost of hardware needed to disseminate it has been paid, provision of the information to one additional user incurs very low or even zero cost. If a significant positive price is charged for the information, then there will be some consumer who does not purchase the information even though the benefit derived would be greater than the cost of provision, because the benefit is less than the price charged. Since the true social cost of providing the information to that user is near zero, it is inefficient for that consumer to not consume the information. Thus, social benefits (net of costs) are maximized if users have access to previously-collected information at a price that is near zero. Given the expense of keeping track of very small fees for numerous transactions, however, it may be optimal to not charge a price for individual pieces of information to individual consumers.

However, the costs of providing the information at all (the costs of information collection and hardware) are much greater than zero and must be covered or no one will obtain the benefits of the information because no one will be willing to sell it. Thus, if ATMS information is provided to the private sector at zero price, then these costs must be covered by tax revenues. But the raising of tax revenue also has inefficiencies because whatever commodity is used as the basis for the tax carries an artificially inflated price after the tax is imposed. This results in too little of that commodity being consumed.

Therefore, in financing ATMS, there is a trade-off between selling the data to the private sector (and accepting that use of the data will be lower) and attaching taxes to other goods (and accepting that use of those goods will be lower). The solution is likely to be a combination of the two -- tax revenue and fee-for-use revenue. In both cases, the least-distorting revenue structure will be one that assesses a lump-sum payment, rather than a per-unit price. As is well-known, taxes which are unavoidable (e.g., poll taxes) are the least distorting (because by definition, one cannot avoid them by changing behavior), but have implications for equity that are often unacceptable. Fee-for-use structures, however, that include a lump sum (access) charge and low or zero per-unit price are feasible. Thus, sales of part or all of the ATMS data base to the private sector could involve the payment of a lump sum fixed fee that does not vary with the extent to which the data are used by the private sector. This would create the right incentives for private sector use of the data.

Charging such a two-part tariff to the private sector will still preclude some consumers from using the information, even though the cost of provision to these consumers would be less than their willingness to pay. This is essentially the free-rider problem -- once the information is ready to be disseminated, the price should be set low in order to reflect marginal costs (the cost of provision to one more consumer); but if the price is set low, then the fixed costs of getting ready will not be covered. If some consumers pay the fixed costs and other pay marginal costs, everyone will want to be in the latter group.

The response to the free-rider problem might be for the local governments (owners of ATMS) to partially subsidize the provision to individual consumers by charging fees to the private sector resellers that are below the cost of creating the information. The difference would be made up by tax revenues.

3. Comparison with other Structures

The structure for the provision of ATMS and ATIS outlined above has certain benefits. First, it affords flexibility in that each metropolitan area can determine for itself whether to finance ATMS through tax revenues or user fees and how to share the cost of ATMS development (among several local jurisdictions making up the metro area) to the extent tax revenues are used.

Second, ATIS sold to individual consumers would be produced at minimum cost and priced competitively. There would be no need for a regulatory mechanism to constrain the investment or pricing decisions of a monopolist.

As for costs or drawbacks to the competitive joint venture structure, these are mainly due to a certain complexity as compared with monopoly production and sales. Investment decisions (but not marketing decisions) must to some extent be made jointly by the owners of the competitive joint venture.

S. Public/Private Consortium Under a Public Agency (Intermediary)

In nearly all circumstances where ATIS and ATMS are being considered for deployment, there are a large number of public and private organizations that are major stakeholders. These agencies include local jurisdictions and all of the potential providers of ATMS and ATIS user services. Unless there is sufficient cooperation among the public and private sector, deployment will be less than fully successful. One possibility for assuring a high likelihood of success is to establish an intermediary organization. This intermediary is a consortium established under a public agency designed to foster the needed cooperation among public and private participants. Discussed below are three potential forms of an intermediary: a MPO (metropolitan planning organization), chapter of ITS America, and HELP Inc.

1. MPO as Intermediary

The most natural candidate within in a region to serve as the intermediary is a MPO, although other regional organizations might potentially play this role such as a bridge, tunnel and turnpike authority. A typical MPO already includes amongst its membership the local jurisdictions and providers of public transportation that serve the region. Many MPOs have both formal and informal structures for engaging the private sector. Usually it is possible to capitalize on these mechanisms to address issues regarding the deployment of ATMS and ATIS. Even more effective, however, is to establish a formal organizational structure under the umbrella of an MPO expressly designed to achieve cooperation between the public and private sectors for the purpose of deploying ATMS and/or ATIS.

There are a large number of different ways to do this. Before determining the best way, some of the organizational issues that need to be resolved are as follows:

- Will the public and private sectors be equal partners in addressing the organizational, institutional, and procurement issues? Many public agencies are unable or unwilling to relinquish a primary role because of their responsibility for managing traffic operations for highways and streets within their jurisdictions. Many public agencies feel that public funds

will be used to finance ATMS and so they feel obligated to take a lead role, especially to manage the procurement process.

- What formal mechanisms will be used to achieve cooperation? Will there be a steering, committee, an executive committee, a memorandum of understanding, some type of contract?

- How will the rights of the public to have access to information be balanced against the needs of private firms to protect proprietary interests?

- How will the public and private sectors share rights to intellectual property developed as a result of attempting to deploy ATMS and ATIS?

With answers to these questions, then a MPO can begin to determine an organizational structure under its umbrella to foster deployment of ATMS/ATIS and at the same time respect vital public and private sector interests.

Appendix A presents a case study of TravInfo, which the Metropolitan Transportation Commission, the MPO for the San Francisco Bay Area, set up to implement an ATIS under a federally funded operational test. The MPO resolved the organizational issues listed above in the following manner. It was decided that public agencies should retain final decision making authority for TravInfo. A Board of Directors was established that contains both voting and non-voting members. The three voting members are all public agencies: the Metropolitan Transportation Commission, District 4 of the California Department of Transportation (Caltrans), and the California Highway Patrol. The non-voting members are also generally public agencies: Caltrans Division of New Technology; the Federal Highway Administration; the Federal Transit Administration; Partners for Advanced Transit and Highways (PATH) which is a university based institution; and the chair of the advisory committee.

TravInfo fosters participation by private firms in two ways. First it includes an advisory committee of 200 which is open to any firm, agency or individual. The advisory committee has a thirteen member steering committee and many working groups to address various topics. Second, TravInfo also permits various organizations to join as participants to encourage value-added resellers and others to become directly involved in the operational test. Typical participants include firms currently providing radio and TV traffic information, manufacturers and providers of in-vehicle navigation equipment and digital map databases, telecommunications companies, and system integrators. Participants must provide their own resources to the project and thus share in the costs of deployment of the ATIS.

TravInfo proposes to treat certain information as being publicly accessible. The rest is to be available through private vendors. TravInfo proposes to offer information on highway link travel times covered by the regional ATMS and transit information as a free basic service. Anyone can obtain this information for the cost of a telephone call. Private firms can also obtain this information to repackage, augment and sell. Repackaged and supplementary information (e.g. electronic yellow pages) would be proprietary and profits from selling it would go to the value-added resellers.

TravInfo addresses the issue of rights to intellectual property by attempting to establish clear boundaries between public and private provision of information. The participant's agreement helps to define this boundary and protects proprietary information and products of those firms or other organizations that sign the agreement.

2. ITS Chapters

A large number of states as well as at least one group of states have formed chapters of the ITS America. The chapters attempt to replicate on a local scale the public/private participation that has been achieved at the national level by ITS America. Chapters typically organize periodic meetings of their membership, develop strategic and program plans, and conduct a variety of outreach activities. ITS America is suggesting these chapters be organized as non-profit 50lc(3) corporations.

Each of the chapters tend to be organized in slightly different ways and with varying focal points:

- ITS Midwest, covering Illinois, Indiana and Wisconsin has a Board of Directors comprised of an equal number of representatives from each of the three stat&. Representatives come from both the public and private sector. There are three vice presidents who are the ITS directors from each of the Illinois, Indiana and Wisconsin departments of transportation.

- ITS Michigan has organized with a president and vice president under a twelve member Board of Directors to be expanded to 18 members.

- ITS California has three focal points, local government involvement, local membership and Project California — a public/private partnership effort coordinated by the California Council on Science and Technology.

Each ITS Chapter can serve as an intermediary organization for its members. Chapters will undoubtedly vary in strength, which is best measured by the degree of influence members have over strategic direction, program initiatives and specific projects. Generally it is expected that contracting authority for ITS projects will remain with the public agencies that comprise the chapters, although it is conceivable that some agencies might be willing to delegate to the ITS Chapter contracting authority if it becomes a non-profit corporation.

3. HELP Inc.

One of the earliest examples of an intermediary set up to deliver ITS services is HELP Inc. It is an outgrowth of the Crescent operational test and the Heavy Vehicle Electronic License Plate Demonstration Program. Both of these were set up to explore the feasibility of using electronic means in the western United States of processing compliance of motor carriers with respect to regulations governing truck size and weights, safety, and border crossings. Electronic techniques such as automatic vehicle identification **(AVI),** weigh-in-motion, electronic vehicle classification systems, and electronic measuring instruments, are among the technology being used.

Both states and the motor carrier industry recognized the prospect of significant cost savings by expanding and further institutionalizing this approach to motor carrier regulation. Accordingly a non-profit corporation called HELP Inc. was established under the State of Arizona's by-laws. HELP Inc. is controlled by a Board of Directors which oversees an Executive Director and a Technical Program Manager. The Board of Directors is composed of a government agency and a motor carrier representative from each state, and thus made up of an equal number of members from the public and private sectors. To obtain a Technical Program Manager for the maintenance and operation of a network of weigh-stations and ports of entry throughout the United States, HELP Inc. contracted with a single company, Lockheed

Corporation (later to become Lockheed Martin). The contractor's responsibilities are to ensure all weigh station and port-of-entry sites satisfy the specifications defined by the states. Also the contractor is responsible for supplying, installing, integrating and maintaining, AVI equipment. The contract is a franchise agreement allowing the prime contractor to act in behalf of all the states and gain access to weigh-stations and ports of entry along highways in order to install equipment. The contract also allows the contractor to develop value-added services for the public and private sectors, and thus generate additional sources of revenue that can defray costs and which can potentially be shared.

In sum, HELP Inc. is a consortium of public and private agencies that have banned together into a single agency — a non-profit corporation — that can contract for services in behalf of the members seeking to carry out a common and mutually beneficial objective. In this particular case, the intermediary entered into an exclusive franchise agreement with a contractor to provide certain types of services. Further details on HELP Inc. appear in Appendix B.

T. Incentive Regulation

One approach to ATMS/ATIS deployment that can be used in conjunction with other models of public/private participation is incentive regulation. Incentive regulations can apply to achieving any performance objective but often involves internalizing externalities. Frequently incentive regulation attempts to achieve public objectives by imposing incentives that force service providers to fully take into account the costs they generate. For example, a public service commission might allow a public utility to retain some of the savings of avoiding peak load capacity expansion that results from instituting energy conservation programs (note: here external costs include the risk and public hardship of energy shortages due to overreliance on expanding supply of non-renewable energy sources in order to meet energy requirements). The concept of incentive regulations can be expanded to include ways to internalize external benefits. For instance, system benefits grow disproportionately as the coverage of an electric power network grows. Providers of an electric power distribution network might be rewarded extra for increasing the coverage area and number of people served.

Regulations that provide incentives (or disincentives) of this sort can potentially apply to the provision of ATMS and ATIS user services. Incentive regulations can be part of the laws or other legal code that states and local agencies adopt governing the implementation of ITS and other transportation improvements. Incentive regulations can also be incorporated into contracts including franchise agreements and concessions.

It is worth noting that incentive regulations can also be used to help ensure an ATMS or ATIS provider considers all costs that accrue over the entire lifecycle of the system including design, build, operate and maintain. Lifecycle contracting, discussed above, is one way to do this, although other procurement models such as Build-Operate-Transfer and Build-Transfer Operate, two variants on a public turnkey project, are better suited to internalizing lifecycle costs over all the stages of deployment.

U. Public Franchise

Franchising has strong appeal for the rapid deployment of ITS because it helps create market conditions attractive to private providers of ATMS and ATIS user services while at the same time creating public benefits. A franchise tends to limit risk by providing considerable market exclusivity to the franchisee in return for meeting public interest objectives set out in the franchise agreement. The franchise

agreement typically specifies a governing body or agent such as a commission or board that is responsible for ensuring the franchisee acts in the public interest.

Franchise agreements appear to be most applicable to ATMS because of the economies of scale that result from avoiding duplicative rights-of-way. Franchise agreements also offer the potential to create an entity that can operate across jurisdictions within a complex multijurisdictional environment.

ATIS appears less well-suited to franchising than ATMS, since it does not depend upon the need for right-of-way access to the same extent, and is probably better provided in a competitive environment. An exception might be a franchise for the provision of the roadside infrastructure for the communication of real time congestion and route guidance information between vehicles and a traffic management center. The provision of this portion of ATIS could be provided under an ATMS franchise. It is also possible this function could be provided entirely through wireless communications and remote surveillance technology such as satellites, thus avoiding the need for roadside infrastructure.

A franchise agreement can incorporate a wide variety of different arrangements for public and private participation. (See Appendix D for a case study of the issuance of a franchise for the Dulles Toll Road Extension. Appendix E offers a case study of trying to franchise high speed rail in Florida.) Some of the possibilities are: the franchise agreement could call for a public turnkey project involving design-build-operate under au exclusive arrangement; it could call for the provision of services within a duopoly; or it could be a completely non-exclusive franchise arrangement. Each of the different models of public/private sector participation that could work within a franchise will exhibit unique characteristics. For example, a franchise involving a turnkey project (e.g. design-build-operate) will permit internalization of lifecycle costs. A duopoly franchise will have sufficient exclusivity to restrict service provision to two firms. On the one hand these firms will have some degree of monopoly power. On the other hand there will be just enough competition to put downward pressure on costs and prices as long as there is no collusion or gamesmanship with a similar outcome. (In the cellular industry, where service is offered through duopoly franchises, prices appear to have gone down not due to meaningful competition but due to customer disenchantment, high customer turnover, and the effort to reach a larger market beyond the high-end business market.) A perfectly non-exclusive franchise, with no restrictions on market entry and exit, would be little different than a purely competitive model, except that the franchise agreement would call for satisfying some public interest objectives.

A franchise agreement may or may not incorporate an external regulatory framework. Such a framework typically governs investor-owned utilities in most states. To the extent the franchise is exclusive (de *facto* or de *jure)* and incorporates a regulatory framework, it becomes a regulated monopoly. Instead of incorporating a regulatory framework, the franchise agreement might incorporate a collateral set of laws by reference. In this case the legal framework and other limitations set out in the agreement would temper any monopoly power conferred upon the franchisee.

Franchise agreements typically set out the conditions for entry and exit from a market, renewal, and may place limits on what the public can be charged for services and the return on investment. The "exit" aspect of the franchise is generally the term limit. There is generally no exit strategy that permits a smooth transition to the next provider unless the franchise agreement includes a build-operate-turnover arrangement. Thus the exit strategy is usually the renewal process, with the likelihood that the incumbent continues. Most franchises do not regulate the rate of return unless they are exclusive franchises for an essential service, e.g. telephone or unless there is a strong public interest concern about using public property for private benefit. If conditions on entry, exit, renewal, rates, and rate of return are not set out

in writing, they are addressed by reference with respect to the regulatory or statutory framework which governs the franchise.

Franchises are typically applied to a particular locality, region or state, and there is no assurance that the terms and conditions of one franchise as it pertains to a particular type of service are the same as the terms and conditions of another franchise in a another location. Thus there is no assurance of uniformity in approach or standardization. If vehicles are unable to interact with ATMS/ATIS in different parts of a metropolitan region or in different parts of the country, then public and private benefits will not be maximized.

The most general definition of a franchise is a special privilege conferred by the government on a private party that does not belong by common right to all citizens generally.[6] More commonly, however, franchise is used to refer to a more specific sub-category of this broader definition: the right granted to a private party by a government to make use of public property for public benefit and private profit.' Classic examples are the traditional public utility franchises (for telephone, water, gas, railroad), whether granted by the state, or in the case of cable television, some public utilities and sometimes taxicab companies, by municipalities or counties. The public property could be rights-of-way, easements, site locations. etc.

Three related characteristics usually typify a franchise. First, a franchise carries with it the obligation to serve the public interest. As the Supreme Court long ago recognized, "a franchise is a right, privilege or power of public concern, which ought not to be exercised by private individuals at their mere will and pleasure, but should be reserved for public control and administration, either by the government directly, or by public agents, acting under such conditions and regulations as the government may impose in the public interest, and for public security."[8]

Second, a franchise usually involves the grant to a private business of the right to use public (i.e., government) property (usually public streets, easements, and/or rights-of-way). Under California law, for example, a franchise is defined as a negotiated contract between a private enterprise and a government for long-term use of public property.[9]

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6 ***E.g.,*** 37 CJS, Franchises §1(a); Black's Law Dictionary 786 (4th ed. 1951).

7 ***E.g.,*** 37 CJS. Franchises §1(a); 12 McOillin Municipal Corporation, §§34.03-04 (3rd edition 1986).

8 California v. Central Pacific Railroad Company, 127 U.S. 1, 40 (1888).

9 Santa Barbara County Taxpayers Association v. Board of Supervisors, 209 Cal App. 3d ***940, 949, 257*** Cal. Rptr. 615,620 (1989).

Third, once accepted by the grantee, a franchise becomes a contract between the grantee and the government. [10] The conditions set forth in the franchise are binding on both the grantee and the government,[11] and give the grantee a property interest in the franchise.[12]

As a legal matter, whether a franchise is exclusive is defined by the terms of the franchise itself. As a general rule a franchise is deemed non-exclusive unless its terms explicitly provide otherwise. For a variety of reasons (relating to federal and state law prohibitions as well as antitrust concerns), there are very few explicitly exclusive franchises in effect today. The 1992 Cable Act, for instance, amended the 1984 Cable Act to specifically prohibit exclusive cable franchises.

While few franchises are exclusive as a matter of law, many franchises may be described as de facto exclusive. In other words, while there is no legal prohibition on granting more than one franchise, only one franchise has in fact been granted. At least until recently, most municipal cable franchises and many public utility franchises (or licenses) granted by state public utility commissions, while not literally exclusive, have in fact been exercised by only one company in a geographic area. The reasons for this phenomenon are threefold.

The first, and in many cases, the historically primary reason, stems from the economics and cost structure of the business activity involved. Businesses that inherently involve a comprehensive, street-by-street local physical distribution system (such as cable television, local exchange telephone service, electric power and water service) have historically exhibited strong natural monopoly tendencies. This is because once constructed, a single system has the physical capacity to accommodate all demand in the area it covers; a second system immediately creates excess capacity. For this reason, at least until fairly recently, only a single franchise existed in a given area for cable and traditional public utility services simply because no one ever even bothered to apply for a second franchise. While this natural tendency still holds true to a certain extent, technological changes, particularly wireless and other bypass technologies in the areas of telephony and cable, are providing competition which is beginning to lessen the effect of natural monopolies, and probably will continue to do so in the future. In addition, the excess capacity that is available in a system can be more effectively utilized due to the availability of new services and higher service rates that were not available in the past, thus possibly making viable multiple providers.

The second reason is that franchises often have such large investments and long maturation periods that the financial recoupment period is too long to be viable unless the franchise were exclusive.

The third reason stems from regulatory requirements. In some states (but by no means all), state utility laws and regulations require an applicant seeking to provide competitive service to demonstrate that the existing franchisee is not providing adequate service. This approach, of course, gives the incumbent an opportunity to oppose any competing applications before the state utility commission, and has in practice either delayed or inhibited competitive franchise grants. A persistent policy problem in this area has been that competitive applications usually seek to provide service to only a limited area or class of customers (the most lucrative ones that cost the least to service), thereby creating a perceived threat to

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10 McOuillin, supra at binding§4.06.

11 id.

l2 See 37 CJS, Franchises § 5 (a).

universal service. In addition, regulatory requirements frequently include financial and experience standards to ensure faithful performance, but these requirements can also represent barriers to entry and contribute to a ***de facto*** exclusive franchise. At the same time, it is fair to say that in most states there have been significant regulatory changes that are designed to make competitive entry much easier. This trend is likely to continue, and indeed accelerate, in the future.

The economic literature provides insight into various issues concerning how to preserve the benefits of market exclusivity in terms of fostering rapid deployment while at the same time obtaining the benefits of competition. Some economists have argued that competitive bidding for a franchise award — where a firm commits to prices at which it will serve the market — achieves the same result as regulation without the need for the regulator to know costs or demand information. The regulator need only conduct the auction and monitor the agreed terms. In effect, this approach attempts to lock the private producer into a competitively induced price through the use of a long-term contract: However, this approach may not be attractive to a franchisor since it limits the franchisor' s participation and influence on the franchisee's provision of a "public service" or which the franchisor can be held responsible.

Other economists have cautioned, however, that under certain circumstances there are reasons to expect a less efficient outcome from franchise bidding. First, comparing bids of various firms will be difficult when criteria are multidimensional, including price and quality measures for example. Second, the contract will need to be renegotiated periodically because of unanticipated events (e.g. changes in cost or demand) that cannot be completely specified. At renegotiation, a new auction must be held or else the incumbent will behave monopolistically. Of course it will be difficult to obtain bidding parity owing to the advantages held by the incumbent. A third reason is that if re-bidding results in award of the franchise to a new firm, the transfer of durable specialized equipment will require regulatory-type assessments of the value of these assets.

V. Business Franchise

Different from the public franchise is the business franchise that normally involves three major components: (1) a trademark or logo; (2) the use of a product or service in conformance with a marketing plan; and (3) a payment of a royalty or fee. Business franchises permit the replication of a business format in a large number of different locations, while often simultaneously offering economies of scale in various elements of the business such as distribution, warehousing, and marketing. Classic examples are 7-Eleven stores and McDonalds. While business franchises are not regulated per se, the franchise agreement includes many contractual features that seek to ensure a proven concept and method of operation is applied uniformly in various geographic locations and to grant specific territory to each, thus giving it some degree of geographic exclusivity.

Business franchises are not incompatible with competition. Quite the contrary. Business franchises are intended to provide advantages within the competitive market place. Business franchises do pose barriers to entry into the company franchise such as a minimum required investment or the costs of purchasing a franchise already in operation, but do not impose barriers of entry into the market place, unless the franchise issuer has market power.

Business franchises typically yield considerable benefits to their customers through cost reductions achieved through economies of scale, unless the franchisee is able to amass great market power, in which case it can begin to charge what the traffic will bear. More likely the market pressures from both existing and potential competitors will tend to keep costs down.

The business franchise concept, coupled with certain regulatory features of a franchised public service has much to commend itself for ITS, particularly ATMS and ATIS. If the federal government's goal is to create a significant degree of uniformity and compatibility of ATMS/ATIS systems across the country, then there must be both a regulatory framework to protect the public interest in franchising service (while at the same time providing the franchisee opportunities to earn a profit with acceptable risk) and a business franchise component to extend the concept to many different locations. This implies that a number of prior conditions must be met, including:

- System standards, communication protocols, and system operating policies must be in place.
- Each area has the infrastructure in place to support ATMS or ATIS.
- There is a local authority responsible for developing local operating specifications consistent with national standards, protocols, and operating policies, and for granting franchise contracts or licenses, monitoring performance and auditing compliance.

In principle, a private firm could develop a concept for an ATMS or ATIS that could be deployed under a business franchise in metropolitan regions throughout the country. This would not obviate the need for the possessor of a business franchise to comply with local laws and regulations that may govern its activity. Similarly, if local jurisdictions granted authority to a regional body such as an MPO under a joint powers agreement, the business franchisee would be obliged to comply with any relevant regulations of the MPO. Local agencies or a regional body with joint powers authority could grant to the business franchise a public franchise giving the right to use public rights-of-way for ATMS or ATIS in return for some public interest obligation.

A business franchise concept for ATMS or ATIS that can be replicated from one part of the country to the next based on national communication standards and protocols is likely to generate more private and public benefits than uncoordinated franchises and most other public/private arrangements.

W. Licenses (government)

The general definition of a license is the right or permission granted by the government to carry on a business or engage in a certain activity which, without the license, would be illegal.[13] This definition is very similar to the broad definition of a franchise, and indeed the terms are sometimes used interchangeably.

While generalizations are somewhat hazardous, there are a few often-cited distinctions between franchises and licenses. First, unlike franchises, licenses typically do not involve any conveyance to the licensee of a right to occupy public property. Thus, the government's requirement of professional, liquor and driver's licenses is not related to the licensee's use of public property.

Second, unlike franchises, licenses do not invariably involve activities that are clothed with the public interest. Rather some licenses clearly relate to businesses subject to public interest obligations while others do not. For instance, recipients of FCC licenses under the Communications Act are subject to franchise-like public-interest obligations; recipients of driver's and liquor licenses are not.

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13 53 CJS, Licenses §2.

Third, unlike a franchise, a license is not a contract, and a licensee usually has no protected property interest in the license. For example the Communications Act of 1934[14] provides that no FCC licensee shall have a property interest in its license or the radio frequency spectrum it uses.

Finally, some older authorities suggest that "if the principle objective is regulation, a grant of authority or power that is only incidental to carrying out the objective is not a franchise but a license.[15] This distinction is a bit misleading, since businesses that are granted franchises are certainly subject to regulation — in many (if not most) cases — as much or more pervasive regulation than businesses that are granted licenses. There is, however, some truth to the distinction as a "paper" matter: Franchises, as contracts, tend to contain the bulk of the substantive terms of regulation in the franchise document itself, and the government's ability to alter those terms unilaterally is somewhat restricted by the contract rights of the franchisee. Licenses, on the other hand, usually contain little in the way of substantive regulatory terms; instead, they merely subject the licensee to a set of regulations, which the government may alter or amend relatively freely during the term of the license.

A license would seem more applicable to ATIS than ATMS on the grounds that there would be a property interest in ATMS (rights-of-way and the ability to use a publicly owned site for a traffic management center) but not in ATIS, with the exception of the roadside infrastructure (rights-of-way for locating beacons that communicate with vehicles). Again, as stated earlier, the portion of the ATIS that consists of roadside infrastructure might be better thought of as part of ATMS. In that case ATIS would not have any property interest from the standpoint of rights-of-way usage.

One could envision, therefore, that jurisdictions comprising a region might agree to grant one or more licenses to private firms to develop a basic ATIS service, consisting of information on the time and money costs of different mode, route, and time of day travel choices bundled with other travel and shipper-related information that resides in a central data base.

The region could use licenses to gram some exclusivity of the market to the licensee and thus limit risk and create profitable opportunities to private firms and thus spur deployment. In the short run, it might be desirable to grant two licenses instead of one in order to have some degree of competition. In the longer run, once deployment has occurred, the region may wish to open the market to all comers. This type of strategy would probably maximize the private and public benefits of ATIS deployment

The granting of licenses is no guarantee, however, that the costs would be minimized. There is no built-in mechanism to ensure internalization of costs over the lifecycle, such as there is with lifecycle contracting or design-build-operate-maintain. This type of feature would have to be built into the license agreement.

X. Concession

The standard definition of a concession is broader than the definition of a franchise or license. ***Black's Law*** Dictionary defines concession as "[a] grant; ordinarily applied to the grant of specific

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[14] 47 U.S.C. §§301 and 309(h).

[15] 37 CJS, Franchises § 7 n. 87.

privileges by government."[16] Some authorities define a concession slightly more narrowly as a "grant or lease of a portion of premises for some use, or of right to enter upon premises for some specific purpose."[17] This definition, particularly, the linkage to use of property, is largely indistinguishable from the franchise definition.

The term concession is used in both governmental and non-governmental contexts. Both private parties and governments grant "concessions" to others to provide or sell services on the grantor's premises. Thus, governments often grant concessions to private parties to sell services or goods (such as refreshments or souvenirs) on public property (such as park or an airport). Private parties sometimes do likewise, such as concessions granted to sell refreshments at a privately-owned ballpark.

Concessions tend not to have a public interest or regulation component. Rather the purpose of concessions tends to be predominantly commercial, both for the grantor and the concessionaire. Also concessions tend to be (but are not necessarily) exclusive in nature, at least within a specific geographic area. This would be consistent with government's predominantly proprietary objectives in granting concessions, as opposed to the government's more public-interest oriented objectives in granting franchises and licenses.

In other countries, concessions tend to be agreements whereby the concessionaire makes promises to provide certain services in return for the exclusive grant of the concession. Because most concessions granted by other countries to firms tend to be exclusive (and hence one-of-a-kind), the regulation or quid-pro-quo is detailed in the concession agreement, rather than in a collateral body of legislation or regulations. Enforcement of the terms of the concession agreement tends to be by way of contractual remedies, or the government uses its own powers to enforce the agreement. The government unit granting the concession also tends to participate in the profit of the enterprise. Concessions tend to require location specific, bargained for, long-term investments by the concessionaire. In the end, a license or franchise may be so conditioned as to operate like a concession, but without heavy reliance on contractual remedies for enforcement. If underlying a concession is a franchise agreement and a fee measured by the franchisee's profits, a franchise and a concession become virtually indistinguishable.

Concessions as narrowly construed and granted in the United States appear to be applicable to neither ATMS and ATIS. Both ATMS and ATIS have strong public interest objectives, which concessions are not designed to serve.

In contrast, suppose a concession were defined as it is often defined overseas and has characteristics nearly indistinguishable from a franchise agreement. Then it would have much applicability to ATMS. It would also have modest applicability to ATIS to the extent it concerned the provision of roadside infrastructure.

A concession for ATMS or ATIS roadside infrastructure, if structured properly, could internalize costs over the lifecycle. The concession could also be designed to create significant profit opportunities (private benefits) and reduce congestion, accidents air pollution, and energy consumption (public benefits) both over the short and long run. Because concessions tend to be exclusive in a particular geographical

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16 Black's Law Dictionary, supra at 361.

17 15A CJS, Concession, at 325.

area, there is not much room for competition. Careful reappraisal over time would be warranted to ensure the costs of forgoing competition do not exceed the benefits of market exclusivity that go with the concession. Therefore the expiration of the concession and/or the period and terms of renewal require careful thought.

Y. Leasing

Leasing can be an integral part of various public/private relationships. Depending upon whether the private or the public sector is the owner at various stages of the lifecycle, leasing is a way to transfer responsibility to another entity for the development or operation of ATMS or ATIS. Leasing has a variety of advantages, compared to purchasing and ownership. These include lower initial costs to the developer or operator in comparison to purchasing, potential tax advantages, and perhaps reduced liability.

Some leasing options relevant to ITS deployment are:

(1) Design, Lease, Develop and Operate: This type of arrangement would have much greater relevance to ATMS than ATIS. A provider of ATMS would lease from a public agency all or parts of the facility for a traffic management center, rights-of-way for optical fiber, and other real property needed to develop the ATMS. The service provider could even lease the equipment necessary, such as computer hardware, although most likely such equipment would be purchased. Once the service provider has leased the property, it would proceed with development. Most likely, but not necessarily, the design phase would have been completed during a business feasibility study prior to raising funds to lease property. Once the property were leased, the service provider would develop, operate and maintain the ATMS. Upon expiration, the lease could be renewed, the property purchased, or the property could be converted to some other use.

(2) Design, Develop, Lease and Operate: In this leasing variation, a private (or possibly even a public agency) might expect to lease part or all of a fully developed system to one or more public or private organizations. This model of public/private participation would appear more applicable to ATIS than ATMS, although a portable traffic management center could be leased by public agencies or even other private firms. In the case of ATIS, a private firm might design and develop the software, including telecommunications, and lease the system to different public agencies. A public agency could operate the system itself or contract with a private operator, whether it be the company that developed the system or another.

(3) Lease, Design, Develop and Operate: Under this approach, a public agency might lease the underlying rights-of-way to a private entity to design, develop, build and operate an ATMS and/or ATIS. To the extent that the public agency places public interest obligations or controls on the lessee, this alternative would be virtually indistinguishable from a franchise.

Z. Private Provision Under Government Aegis

Under this model, government grants to the private sector the right to provide a service under the banner of government, thus creating a market opportunity or added revenue not otherwise possible. A private firm acts as an extension of government perhaps even using a government logo. There is a quid-pro-quo usually consisting of private provision in exchange for the right to act in behalf of government. However, the quid-pro-quo can involve additional private contributions or revenue sharing, especially if

the right to act in behalf of government is essential to a profitable service. An example of private provision under government aegis is the Westchester County agreement with Metro Traffic Control to develop traffic data.

Provision under government aegis is fundamentally different from contracting because the government does not pay the service provider. Rather, by virtue of the government's control over rights-of-way, certain information, or the necessity of the motoring public to conform to certain regulations, a profitable market can be developed if government grants to the service provider certain privileges or the right to behave as if it were government.

Consider, for example, one way for a service provider to develop a profitable ATIS service as an extension of government without government having to contract for services. Government has primary access to data generated by traffic signal systems and other advanced traffic management systems. Because of "Freedom of Information" laws and other requirements for open access to public information, it may not be possible for a public agency to exclude anyone from obtaining traffic data developed with public funds. However, government agencies may be able to allow one firm more timely access to data than another, thus giving it a competitive advantage in the market for real-time traveler information. This might be a sufficient advantage to induce a private provider to set up an ATIS even with the prospect of competitors marketing more stale information to the traveling public.

AA. Monopoly Regulation

A common framework for deploying services where there are strong natural monopoly characteristics is public utility regulation. Under this model, a regulatory agency such as a state or local public utility commission, issues a certificate of convenience and necessity that permits a private entity to undertake service provision usually for a specific service area. The regulatory agency grants a franchise and sets the rates the service provider charges consumers and the rate of return to private investment. This is the model that was followed in the early years of the mass transit industry and is widely used for electricity, gas, and other utilities.

Many state regulatory agencies have a sophisticated professional staff which advise a regulatory commission on plans, investment proposals, consumer rates, return on investment, and related issues. In states such as Oregon and Wisconsin, the commission is required by statute to apply a "least cost planning" methodology to ensure that demand management, alternative energy sources, and low cost capital options are used in lieu of major capital investments whenever it is cost effective. Thus the regulatory process seeks the most cost-effective approaches to satisfying customer needs over the lifecycle of major capital equipment.

This type of regulatory framework is growing in attractiveness, and a number of states are exploring the possibility of undertaking transportation planning within the context of this "least cost planning approach." Indeed, the process is highly consistent with the planning, programming and project development requirements under ISTEA.

ATMS/ATIS could be deployed within a regulated monopoly framework involving franchising and least cost planning, much the same way that is done in some states with regard to regulation of electric utilities.

There are a number of practical problems with this approach, however. First, there are compelling reasons in nearly all industries to try to use market forces instead of regulation to impose discipline and temper the monopoly power of firms that would otherwise be sole providers. Frequently market approaches have lower overall costs and administrative burden. Also regulation is not as conducive to. technological innovation which invariably leads to lower consumer costs and higher quality service in the long run. Utility commissions now foster competition by independent service providers of wind, solar, biomass, and other forms of energy. These are alternatives to centralized coal or nuclear power plant generation occurring under a monopoly franchise.

Second there is increasing public distaste for government regulation. Politicians and the public are likely to reject deploying infrastructure and other technological systems that involve regulation if any reasonable alternative can be found. The public increasingly favors privatization and free market solutions and appears to be more willing to accept the risk of abuse of market power than to put up with more government regulation. Nevertheless, in many circumstances the potential abuse of monopoly power is so great, there is no alternative to some type of regulation.

BB. Decision Tree for Selection of Appropriate Models

Under different circumstances it is most appropriate for the private sector, the public sector or both to provide ATMS/ATIS user services. The decision as to which of the 27 institutional models described above is most relevant to a particular situation depends upon the following:

(1) Whether the public policy is to treat the service(s) to be provided as a pure public good(s), private good(s) or a combination of both. To repeat, a pure public good is a service or product that once provided to a person is available to everyone. As result it is available for free and cost recovery is not possible.

(2) The willingness of consumers and/or taxpayers to pay for the services. When consumers are willing to pay, they will make a market that induces private providers to offer the service for profit. Sometimes consumers are unwilling to pay, but the taxpayer is, or a combination of consumers and taxpayers are willing to pay. It is important to define the service area and period of time over which the service will be offered in order to determine willingness-to-pay.

(3) Whether economies of scale in production or service provision are present (other than the need to avoid duplicate use of rights-of-way). Economies of scale might arise in merging data bases or in manufacturing. There are a number of implications of significant economies of scale. The first is it creates conditions of natural monopoly, since the service provider can always undercut the price of competition and drive competitors out of the market by expanding output and lowering price. In addition under conditions of economies of scale, average and marginal costs will be constantly declining, so cost recovery is not possible based upon marginal cost pricing, which is usually the economically efficient price.

(4) Whether access to rights-of-way are needed. Government agencies have control over local streets and are required to enforce the laws of their use and operation, including the need to avoid duplicate and disruptive use rights-of-way. In addition, government recognizes that publicly owned rights-of-way has value in the market place and will try to seek appropriate compensation for use of public property by private firms.

(5) Whether home rule or metropolitan rule applies. Some jurisdictions are unwilling or prohibited by law to cede control or authority governing the use and operation of their streets and highways to a higher regional body. In other cases joint powers authority exists that allows multiple jurisdictions within a region to act in consort. Some deployment models are germane to a single jurisdiction while others can help form cooperative relationships among multiple jurisdictions. These cooperative relationships involve not just participating jurisdictions but also may apply to private sector providers.

(6) Whether legal authorization exists to support deployment under the specific model. Many models cannot be implemented without appropriate state and local authorizing legislation.

Figure 3 provides a decision tree that can be used to select the most appropriate model based upon the first four criteria listed above: public and/or private good, consumer and/or taxpayer willingness to pay, presence or absence of economies of scale in production, and whether right-of-way access is needed. These four criteria address issues of market characteristics and barriers to market entry. The remaining two criteria depend upon existing legal authority and the extent of multijurisdictional cooperation required within the area where ATMS/ATIS will be deployed.

To illustrate how to apply the decision tree, an example is presented (See Figure 4). The product is considered to be a pure public good, and in addition the consumer is not willing to pay for the product in the market place. The manufacture and distribution of the product has economies of scale and the sale of the product requires the use of public right-of-way. Assume further that the product under consideration is to be offered in multiple jurisdictions. Whether legal authority exists to implement the model cannot be determined until the type of model is selected.

The results of using the decision tree involving the first four criteria is that pure public provision is an appropriate approach. The decision tree also shows that the following additional models are relevant: Public Owner-Builder (2), Standard Low Bid Contracting (3), Lifecycle Contracting (4), Performance Contracting (5), Public Turnkey (6), (10) Public/Private competition, which is a form of contracting, and System Manager (14). Each of these models would have to be tailored to a multi-jurisdictional environment. If any of these models were to be implemented, there would have to be corresponding legal authority.

Figure 3
Decision Tree

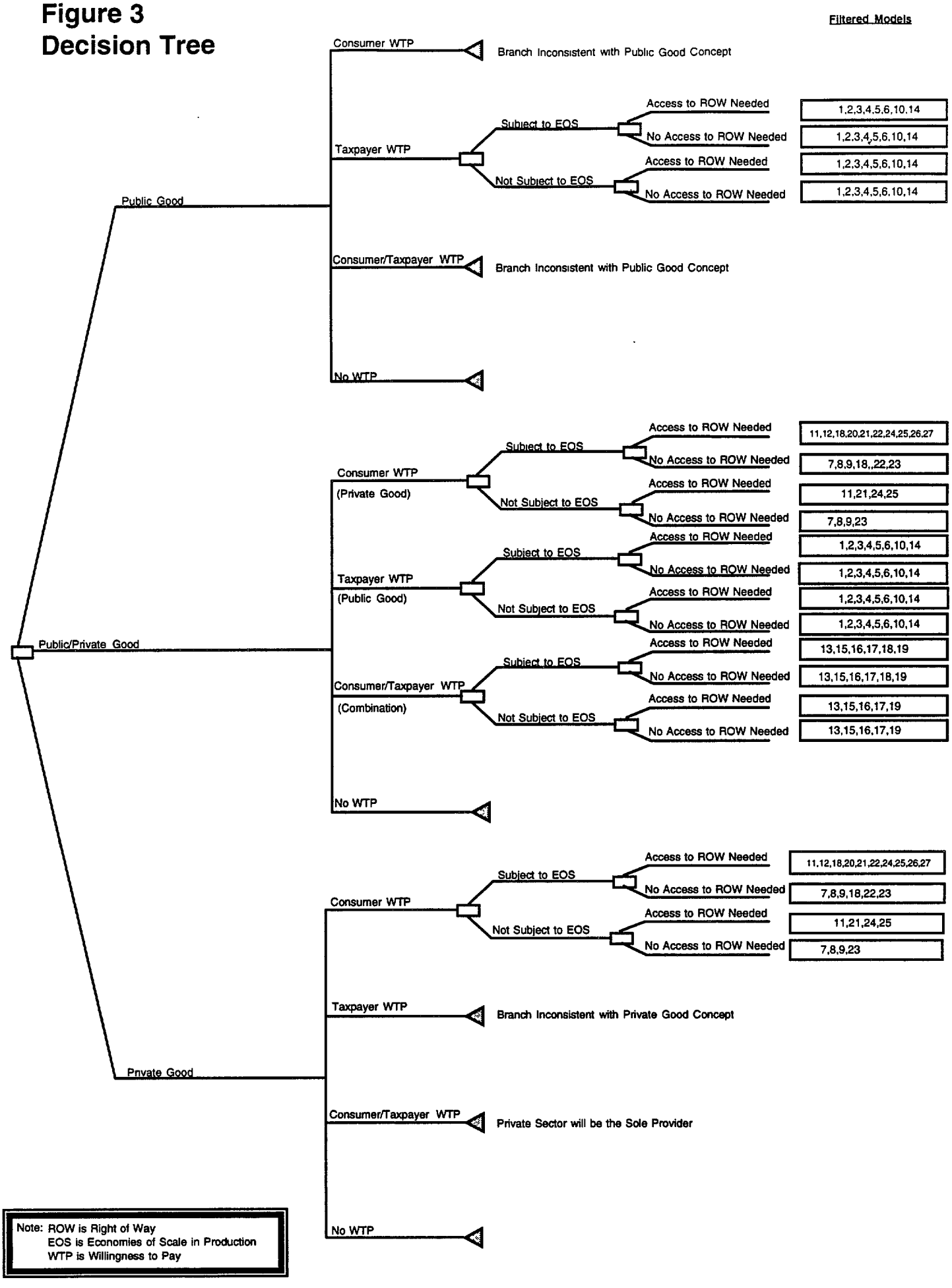

Figure 3 (Cont.)

Key to Models

1. Pure public provision.
2. Public owner-builder.
3. Standard low-bid contracting.
4. Lifecycle contracting.
5. Performance contracting.
6. Public turnkey (including Build-Transfer-Operate and Build-Operate-Transfer).
7. Private owner-builder.
8. Private turnkey.
9. Private competition.
10. Public/private competition
11. Auction.
12. Yardstick competition.
13. Open solicitation of public/private partnerships.
14. System manager.
15. Cost sharing.
16. Joint ownership.
17. Functional division of responsibilities.
18. Competitive joint venture.
19. Public/private consortium under a public agency (Intermediary).
20. Incentive regulation.
21. Public franchise.
22. Business franchise.
23. License.
24. Concession.
25. Leasing.
26. Private provision and revenue sharing under government aegis.
27. Monopoly Regulation.

Figure 4
Example Showing Selection
of Model Based on
Decision Tree Criteria

Filter	Single Jurisdiction	Multiple Jurisdiction
A. Market Characteristics 1. Type of Good Pure Public Public-Private Pure Private 2. Willingness to Pay Consumer Taxpayer Consumer-Taxpayer None		
B. Barrier to Entry 1. Economies of Scale Existence of EOS No Existence of EOS 2. Right of Way Access Needed No Access Needed		Multi-jurisdictional Pure Public Provision
C. Multi-jurisdictional		Joint Powers Authority Exists
D. Authorizing Legislation		No Limiting Legislation and Regulations are Present

CC. Other Models

The models described above give a fairly comprehensive picture of the spectrum of institutional possibilities ranging from pure public provision of ATMS/ATIS to pure provide provision, and many. combinations in between. The list of models, however, is by no means exhaustive. Indeed, both the private and public are constantly developing new variations and approaches to deploying advanced technological systems.

Many additional models of deployment have been identified during the course of this study, some in the Task B Report, "Lessons from Other Technologies," and others in symposiums and workshops held in conjunction with this and related studies.[18] Briefly, other models that have been identified are as follows:

- ***Build-own-Operate.*** The public sector lacks the finance to develop a project but can support it by granting right-of-way and land to a private entity. The private entity then builds a facility with its own capital, and thereafter owns, operates and collects revenues on the facility indefinitely. The government continues to own the right-of-way or other public property.

- ***Temporary Privatization.*** The private sector assumes operation of an existing facility, first repairing, upgrading, or expanding it. Then the private operator charges a user fee and collects revenues until it covers its cost and earns a reasonable return. When the public sector grants the right to take over operation of its own facilities, operation must still be in conformance the responsibilities and obligations of the public sector as required by law.

- ***Wraparound Addition.*** The private sector is permitted to build an addition to an existing publicly owned facility, and then to own, operate and generate revenues from the add-on. An example might be a privately provided addition to a publicly owned transit terminal.

- ***Value Capture.*** The public sector grants to the private sector the rights to capture the appreciation in the value of property as compensation for the financing and development of the property. There are many techniques for fostering value capture including tax-increment financing, establishment of benefits districts, selling air rights, and so on. The original financing scheme for Florida's high speed rail system was based upon value capture.

- ***Sale/leaseback.*** This is a variant of a Build-Transfer-Operate model. In this instance a private entity develops a facility, sells it to the public sector, and then leases it back to operate the facility. The developer is able to raise the capital to construct the facility because the government agency will pay back the construction costs once the completed facility is sold to the government. Consequently, the fees charged to users of the facility need not have to cover financial carrying costs pertaining to original construction but only operating costs, including the lease. This type of arrangement substantially reduces the risks to private investors financing initial construction, and also reduces the size of user fees.

I8 Partnerships in the Implementation of IVHS, participants notebook prepared by Click, Kent and Allen for workshops sponsored by the Federal Highway Administration.

- ***Bartering (shared resources).*** In this model the public sector and the private sector trade resources in a way that makes possible the provision of services or products. For example, the public sector might exchange dark fiber that has been previously installed in the right-of-way for the private provision of certain types of ATIS user services, for example, feeds of CCTV traffic surveillance to a traffic control center and cable TV stations.

- ***Partitioning of Public and Private Sector Involvement by Risk.*** Here the public sector might assume responsibility or provide guaranteed revenues to cover the high cost, low risk portions of deployment while the private sector takes responsibility for the low cost, high risk elements. In many different industries, government has helped fund the basic infrastructure -- the high cost, low cost portion -- while individual private sector companies seek to develop value-added products and services through entrepreneurial activity. An example where the government guarantees the revenues to cover the high-cost, low risk portion of investment is the following. The private sector funds the installation of fiber optic cable in exchange for a guaranteed fixed (risk free) lease fee, while granting access to this conduit to competing private sector service providers. This approach partitions the public sector concessions in proportion to risk, and makes it unnecessary to offer concessions to service providers, since they would not have large amounts of capital at risk to build costly conduit in addition to paying for the incremental cost of providing service.

- ***Crown Corporation.*** The U.S. postal service operations were deployed using this approach. The national government (it could also be a state government), establishes a monopoly corporation which sells services and products to cover the costs of operation. Taxpayer revenues could cover any losses that may arise.

- ***Cross Subsidy Model.*** Under this approach, a provider of both ATMS and ATIS services cross subsidizes ATMS with ATIS revenues. The price of ATIS would be increased to reflect the subsidy to ATMS. Indirect subsidies are effective if the subsidizing service is not subject to competition, as the history of the telephone service prior to AT&T divestiture shows (i.e. revenues from long distance telephone calls subsidized local universal service). In fact this cross subsidy persists even now that AT&T is no longer both the long distance and local telephone service provider, because monopoly Regional Bell Operating Companies charge local access charges to long distance telephone companies.

- ***Regional R&D Technology Centers.*** This pre-deployment model of public and private participation involves the establishment of regional technology centers that draw on the research expertise of in-house staff and academics in local universities to offer customized services for regional manufacturers. Costs of establishing and operating the technology centers are covered with state and federal grants and fees for service (low fees for technical assistance and technology transfer and higher fees for exclusive licensing arrangements with member companies). Ohio's Edison Technology Centers are an example of this model.

- ***Non-Profit Technology Development Corporation.*** A state establishes a non-profit corporation to provide funding and technical assistance for new high technology firms and established manufacturing companies. A state may provide funding to support applied R&D and development of product prototypes as well as commercialization of R&D. The non-profit status of the corporation tends to insulate the corporation from changing political priorities.

Indiana's Business Modernization and Technology Corporation is an example of this pre-deployment model.

- ***Venture Capital Technology Development Corporation.*** A corporation, publicly endowed with federal and/or state funds, is set up to make equity investments in promising high technology firms through stock purchases in order to leverage additional investment by venture capitalists. This corporation realizes gains through stock sales when the high tech firms go public or other companies acquire them. The Massachusetts Technology Development Corporation is an example.

- ***Science and Technology Council and Development Project.*** This predeployment model occurs in two phases. First, a state establishes an advisory panel (council) composed of representatives from business, government, labor and academiato conduct assessments of the desirability of increasing the technological capacity and competitiveness of various industries. Then public/private collaborative projects involving government and industry funding with research capabilities of universities and industry are pursued to develop improved or new technologies. The State of California followed this approach beginning with establishment of the California Council on Science and Technology followed by establishment of Project California to develop ITS and other advanced technologies.

DD. Summary and Conclusions

This report has sought to describe the spectrum of possible ways to implement ATMS/ATIS. Some models of public and private participation pertain to such pre-deployment activities as R&D, operational tests and system architecture development. Other models concern the design, construction, operation and maintenance of working systems intended to function over a long period of time. A few models apply to both pre-deployment and deployment such as turnkey (BTO and BOT) and system manager.

Different circumstances will demand different approaches to the deployment of ATMS/ATIS. Certain models are more conducive to ATMS deployment while others are more conducive to ATIS deployment. A number of approaches are applicable to both. We have seen that some institutional frameworks will speed up deployment in comparison to others. We have also seen that market characteristics of the specific services (e.g. public vs. private goods and willingness to pay), barriers to entry (e.g. economies of scale and the need to gain access to rights of way), the presence of multiple jurisdictions, and legal authority all influence which models are relevant.

Although this report contains a detailed catalogue of different models, they are not mutually exclusive. Various models can be mixed and matched to provide an institutional framework suitable for implementing ATMS/ATIS in a particular region or locale.

It is highly desirable to focus upon those institutional models most likely to foster deployment of ATMS/ATIS. Early deployment efforts should include a spectrum of the more promising approaches. Deployment demonstrations are needed, not operational tests, so that ATMS/ATIS is actually implemented in a variety of settings. The ITS community will then be able to learn from a variety of experiences and fine-tune the most effective approaches. Operational tests, by definition are not the same as deployment. Often all the elements of an operational test are dismantled upon completion. However, many regions do try to permanently implement the useful elements of an operational test once it is completed.

Finally, the competing demands for scarce resources in both the public and private sector make it highly desirable for both sectors to leverage each other's funding, staff, and property. This is not merely a matter of financial necessity or desirability. Generally it will also help to ensure that the public benefits of reduced congestion, air pollution, and accidents will be as large as possible and the private sector will reap the greatest possible profits.

For the convenience of the reader a summary of the applicability of different models of public/private participation to ATMS and ATIS follows.

Because the user services of ATMS are typically public goods, (i.e. free to the public), some form of public provision is most logical assuming taxpayers are willing to pay and ATIS is independently provided. In this case, the following models are most relevant to deployment:

- Pure public provision
- Public owner-builder
- Standard low bid contracting
- Lifecycle contracting
- Performance contracting
- Public turnkey (including Build-Transfer-Operate and Build-Operate Transfer)
- System manager.

These approaches are not mutually exclusive, For example, pure public provision can involve any form of contracting or employ a public agency as a system manager.

If ATIS user services are all treated as pure public goods, then the same deployment models listed above for ATMS are relevant.

If ATIS user services consist of purely private goods (e.g. ATIS services are not free) consumers are willing to pay enough to cover costs and profit, there are no significant economies of scale in production, and no access to rights-of-way is needed, then these models are most pertinent to ATIS deployment:

- Private competition
- Private owner-builder
- Private turnkey
- Licensing.

If instead ATIS requires access to rights-of-way, unless government grants easements or permits or issues a grant-of-title, these forms of pure private provision are insufficient. Instead the most relevant models are:

- Public franchise
- Concession (with features similar or identical to a franchise)
- Leasing in various forms (e.g. design, lease, develop, operate)

Note that if the ability to provide ATIS under a franchise, concession, or leasing arrangement can be made profitable, then potentially the right to deploy ATIS under these options can be auctioned.

If there are significant economies-of-scale in production of ATIS, especially data base development, two models of deployment are relevant and can apply when there is pure private provision or when private provision requires access to public rights-of-way:

- Competitive joint venture
- Business franchise.

Both these approaches can employ any standard method for gaining access to public rights-of-way ranging from easements, to grants-of-title to a public franchise. Thus for example a private firm could develop a business franchise concept for ATIS to be applied in metropolitan regions throughout the country and in each region would negotiate with the MPO (if it has joint powers authority) or local governments to gain access to rights-of-way by different means (e.g. easements, leasing, public franchises).

Similarly ATIS could be provided under a competitive joint venture involving, say, three firms initially. Each firm might have a public franchise to install surveillance equipment in the rights-of-way of different government jurisdictions. The three firms under the competitive joint venture agreement would pool their traffic related data and be co-owners of the ATIS data base containing travel times by mode, route and time of day. Then each would compete against one another to sell ATIS user services either directly to the public and businesses or to value-added resellers.

If ATMS and ATIS are jointly provided so there is a potential for revenues to defray some or all of the costs of ATMS, then it is implied that some user services of ATMS/ATIS are public goods and some private goods. If taxpayers are willing to pay for the services but consumers are not, then some type of public provision is required such as pure public provision, various forms of contracting including public turnkey projects, or the use of a system manager to help public agency deployment.

If consumers are willing to pay for the joint provision of ATMS and ATIS, but taxpayers are not, then the same deployment models apply as those applicable to private goods where consumers are willing to pay and access to rights-of-way are needed:

(1) If there are no economies-of-scale in production (other than the need to avoid duplicate use of rights-of-way), then public franchises, concessions, and leasing are most applicable assuming easements, permits, grants-of-title, etc. are not used to grant access to rights-of-way. Furthermore the rights to franchises and concessions could be auctioned.

(2) If there are significant economies-of-scale in production and right-of-way access is required in the joint provision of ATMS and ATIS where only consumers are willing to pay, then many models typically used in regulated industries as well as some others apply:

- Monopoly regulation
- Yardstick regulation
- Incentive regulation
- Public franchise
- Concession
- Leasing
- Private provision under government aegis
- Auctions
- Competitive joint venture
- Business franchise.

Finally, there are situations where the provision of ATMS and/or ATIS includes or has characteristics of both public and private goods and both taxpayers and consumers are willing-to-pay. Some approaches relevant here are as follows:

- Open solicitation of public private partnerships
- Cost sharing
- Joint ownership
- Functional division of responsibilities
- Competitive joint venture
- Public/private consortium under a public agency (intermediary).

The different approaches to deployment of ATMS/ATIS summarized here are only those which this report focused upon. There are many additional approaches to which this report only briefly alludes. Also many models of public/private participation will accommodate means to generate supplemental revenues that can contribute to cost recovery or profitability. These supplemental revenue sources might include selling dark fiber (i.e. telecommunication capacity of unused fiber optic cable), advertising, and concessions for services unrelated to ITS, such as food and lodging.

Finally, it is important to acknowledge the role that MPO's and chapters of ITS America play in fostering public/private partnerships as well as the role of open solicitations for public/private partnerships used in such states as Washington and Minnesota in fostering an innovative approach to procurements.

APPENDIX A - CASE STUDY OF TRAVINFO

Travlnfo is an Advanced Traveler Information System (ATIS) for the San Francisco Bay Area. which is being implemented through a unique public/private partnership arrangement. TravInfo has been approved as a federally funded operational test. Eventually this ATIS is intended to provide link travel times on the roadway network and detailed information on transit route, schedules, stops and fares, as well as complementary information on weather, bicycle routes, special events, and so on. TravInfo also includes a computer aided dispatch system for incident management on the freeway system, a tow-truck monitoring system which maps the location and speed of some fifty vehicles operating during peak hours, and a local roadway database derived from local traffic operations centers.[19]

As originally planned, the operational test was to use freeway-related data from a traffic operations system covering the 500 mile Bay Area freeway system and metering of 120 of the 770 freeway on-ramps. This system would include loop detectors, closed circuit television (CCTV), highway advisory radio (HAR), and changeable message signs. However, a contractual problem has resulted in the implementation of a scaled-down system for the TravInfo operational test. The scaled-down version will provide travelers with congestion, speed, and incident data for only 150 miles of freeway. Additional travel time, congestion, and speed information will be gathered via probes.

A. Institutional Setting and Organizational Structure

TravInfo is being implemented within an exceedingly complex multijurisdictional environment composed of local, regional, and state government. The region comprises well over a hundred local jurisdictions. There are 1,949 miles of highway, 672 miles of interstate freeway and expressways, and 19,643 miles of local streets and roads. Caltrans (i.e. the California Department of Transportation) and public authorities own and operate the interstates, state highways, and the major bridges while local jurisdictions have authority over local roads and streets. Operating within the region are 25 public transit providers and 32 paratransit providers. The region also has many other major transportation facilities including airports, ports, and railroad tracks and terminals.

TravInfo is managed by a Board of Directors composed of voting and non-voting members. The three voting members are the Metropolitan Transportation Commission (which is the Metropolitan Planning Organization (MPO) for the region), Caltrans District 4, and the California Highway Patrol. The non-voting members are Caltrans Division of New Technology, the Federal Highway Administration, the Federal Transit Administration, Partners for Advanced Transit and Highways (PATH) which is a California university based institution and the chair of the advisory committee. An advisory committee of 200 members, with a 13 member steering committee and many working groups, was formed to ensure traveler

19 This case study is based upon interviews with personnel from the Metropolitan Transportation Commission and the California Department of Transportation. It is also based to a large degree on the following reference: Melanie Crotty, Joel Markowitz, Lawrence E. Sweeney, and Jeff Georgeovich, "TravInfo: A Progress Report," Intelligent Transportation: Serving the User Through Deployment. Proceedings of the 1995 Annual Meeting of ITS America, March 15-17, 1995, Washington D.C., pp. 297-306.

information is formatted and summarized to be useful to both commercial vendors and the genera1 public. Membership in the advisory committee is open to any firm, agency, or individual.

TravInfo also allows various organizations to join the operational test as a participant. The intent. is to encourage value-added resellers to become directly involved in the operational test. Participants must provide their own resources, since the operational test does not have funding to support the participants' activities. At the time of this writing their were over twenty participants signed up. Participants sign a formal agreement. This includes a non-disclosure arrangement between TravInfo and each participant.

B. Free and Value-Added Services

The operational test is expected to offer two principal categories of services. The first is a Travel Advisory Telephone Service (TATS), a free service, apart from the cost of a phone call. TATS will allow callers to obtain information on congestion, transit status, and comparative travel time information. Human operators will provide callers assistance regarding ridesharing and transit questions.

The second major category of service will be provided by commercial vendors who will take information in the core data base and modify, format, or supplement it in ways that can be sold in the market place for a profit.

C. Challenges

TravInfo is facing a number of serious challenges not the least of which is the contractual difficulties with respect to implementing the Traffic Operations System that would have provided real time link data on 500 miles of freeway within the region.

Among the other key challenges is creating an environment where value-added resellers can profit while TravInfo offers certain core ATIS data essentially for free (i.e. treats it as a public good). On the one hand, the free availability of basic ATIS service promotes the widespread use by the public of traveler information, increases public benefits (i.e. reduction in congestion, air pollution, energy consumption, and accidents), and enhances the probability that in-vehicle navigation and routing devices that use real-time traveler information data will be deployed.

On, the other hand, the availability of free information undercuts the feasibility of cost-recovery or a self-sustaining, profitable ATIS system. Moreover, to the extent that core ATIS data is free, TravInfo forgoes an opportunity to generate a revenue stream that can be used to finance the expansion of ATMS infrastructure, the source of much real time traffic data, although an ATIS is not entirely dependent on wire-based traffic surveillance systems.

It is worth noting that if ATMS is entirely publicly funded, and ATIS core traveler data is provided for free, the economic rents (i.e. the value of the service as reflected in what people pay for equipment, services, etc.) will be captured by vendors of in-vehicle navigation equipment, telecommunications suppliers, and value-added resellers, and no revenues will be available for reinvestment in ATMS.

Highly related to these issues is the willingness of taxpayers and consumers to generate the financial resources to fund an ATIS integrated with an ATMS. There is considerable taxpayer resistance. The resistance has many different roots: distaste for higher taxes, unwillingness of local elected officials to cede local control over roads to a metropolitan authority, and doubts about the advantages of spending

money on ITS in comparison to highway construction, paving and maintenance projects or in comparison to transit projects.

In light of this taxpayer resistance, the MTC and TravInfo are searching for ways for the public and private sector to leverage each other's scarce resources. Indeed TravInfo, is premised upon a public/private partnership. However, this partnership will prove to be merely for the convenience of the operational test unless an effective institutional mechanism can be found to sustain and expand the ATIS/ATMS system once the field operational test is over. The MTC is in the process procuring an operator for Traffic Information Center, and is exploring ways the operator might generate revenues that help cover part of the costs or make the operation self- sustaining. The possibility of privatizing the traveler information service, once the operational test has been concluded has not been ruled out.

A major challenge within TravInfo, as well as other similar activities around the United States, has been to carefully and sharply define the boundary between public and private sector activity. As originally conceived, the boundary between public and private sector activity is both murky and clear. It is murky because both the public and private sector will be distributing ATIS information. However, the distribution channels for public and private traveler information services are clearly defined. The public sector will offer free information over the publicly funded TATS, while the private sector is presumed to provide superior value-added services by other means, including radio, television, kiosks, and so on. Over time, TravInfo and the MTC will need to change the boundary between public and private activity.

D. Lessons for ITS

TravInfo currently has an institutional approach not unlike that of the National Weather Service. It is predicated upon making available to the public and value added resellers certain basic data which is offered essentially for free. Value-added sellers can package this data in many different ways and add data to sell information services for a profit. However, in this day-and-age of scarce financial resources, it is unclear whether this is a viable approach in the long run. Even the National Weather Service is under enormous political and economic pressure to abandon its traditional approach in favor of selling services to cover costs, or at fair market value, and to privatize services wherever possible.

TravInfo is dependent upon ATMS for much of its core data, yet there is no financial mechanism that ties ATIS revenues to investment in ATMS. A strong lesson here is that ATIS may be overly dependent upon the performance of contractors and their procurement agencies for timely deployment of ATMS. Instead there may be a variety of institutional mechanisms that take a more integrated approach to the deployment of ATIS and ATMS. Whatever institutional approach is selected, it will be essential to clearly define the boundaries between public and private activity. To the extent that the private sector will be relied upon for provision, some degree of exclusivity will probably be required at the outset to provide sufficient profit incentive for private investments. Franchising, licensing, and other contractual arrangements that provide a wholly or partially exclusive right to provide traveler information services will likely be necessary. In addition, considerable vertical integration should be allowed.

It will never be possible to overcome the challenges of implementation in a highly multi-jurisdictional environment unless the desire for local control is fully respected and a mechanism is found to build upon that local control for the benefit of a region. Part of TravInfo's plan is to allow local traffic operations centers to furnish information to a common data base. This is a voluntary arrangement that may not go far enough in acknowledging the value of rights-of-way owned and controlled by local

governments and the inability of local governments to completely give up their police powers regarding the use and operation of local roads and streets.

APPENDIX B - CASE STUDY OF HELP INC.

HELP Inc., a non-profit corporation, was organized as an instrumentality of the states to contract for services, via a franchise, to develop and deploy advanced technology systems to enhance commercial vehicle operations to the benefit of industry and government. HELP Inc. provides an institutional mechanism that allows the states and the motor carrier industry to work closely together in a way that neither individual states nor specific private firms could accomplish. In particular, HELP Inc. is able to enlist a franchisee that can serve as a facilitator between the public and private sectors, provide technical assistance, and develop a variety of profitable businesses whose revenues can be used to offset the costs of HELP Inc.

HELP Inc. was an outgrowth of the Heavy Electronic License Plate program and the Crescent Demonstration Program. Both of these efforts were designed to test and evaluate the feasibility of using electronic methods to enhance the efficiency of motor carrier regulation, including that pertaining to credentials, safety, and taxation. More specifically, the mission of HELP Inc. consists of the following:

- Reduce government and industry tax burdens by promoting compliance with size, weight, and tax laws and improving the efficiency and effectiveness of motor carriers and government in handling these administrative and regulatory matters.

- Establish, develop and maintain reliable and secure communications network connecting various motor carrier monitoring locations, government and industry administrators in order to facilitate the lawful exchange of information and the filing of tax returns, reports and remittances.[20]

- Government and industry may contract exclusively with HELP Inc. in fulfillment of this mission.

A. Organizational Structure

Half the active members of HELP Inc. are government members and the other half are representatives from the Motor Carrier Industry. Any state, province or territory in the United States, Canada, Mexico, or the District of Columbia can be a member. Each government member must identify a corresponding member that is a private firm in the motor carrier business. Active members have voting rights and can hold office. HELP Inc. also has affiliate and associate members. Every active and affiliate member is on the Board of Directors. The Board of Directors has an Executive Committee composed of six individuals, including a Chair, Vice-Chair and Secretary/Treasurer. HELP Inc. also has an Executive Director who is the chief executive officer. HELP Inc. was incorporated in Arizona pursuant to the provisions of the Arizona Nonprofit Corporation Act.[21]

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20 Briefing materials for H.E.L.P Inc. Charter Board of Directors Meeting, Sacramento, California March 21-24, 1993, Section A, Vision, Mission and Goals.

21 Ibid., Section D, Articles of Incorporation.

B. Responsibilities of the States Vis-a-Vis HELP Inc.

Some insight into the relationship between the HELP Inc., and each of the states can be gleaned from a draft letter of intent on the part of states to join HELP Inc. The draft letter sets out the following principles of agreement:

(1) HELP is to charge the motor carrier industry for services provided at rates the Board of Directors establishes

(2) The state is to provide an infrastructure with HELP at weigh stations located at ports of entry, subject to state funds being available. HELP will provide the technical specifications to the states at no charge.

(3) The state is to define which credentials are needed to pre-clear trucks (i.e. trucks don't have to stop to have credentials checked) and give HELP the access it requires to determine if trucks have valid credentials and safety ratings.

(4) The state and HELP Inc. agree that the goal is to transmit the needed data electronically while at the same time protecting the confidentiality of data.

(5) The state is to pre-clear at weigh stations motor carriers enrolled in the HELP program.

(6) The state is to make its infrastructure compatible with HELP System specifications

(7) The state will respect the commitments to motor carrier data privacy made under the Crescent Demonstration Program.**

C. Private Sector Benefits

Benefits of HELP Inc. to private industry include reduced travel delay, reduced administrative burden, transparent and international borders, pre-clearance on mainline routes, one-stop shopping for credential processing, and the establishment of new information services, including electronic data interchange and advanced traveler information services.

D. Role of Franchisee

The institutional structure for HELP Inc. was conceived largely by Lockheed Corporation which was the original contractor for the HELP program. Lockheed eventually became the franchisee under HELP Inc.

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22 Draft materials entitled "Partnerships in the Implementation of IVHS" for public/private sector workshops on ITS prepared by Click, Kent and Allen for the Federal Highway Administration., pp. A-19 through A-21.

The documents for the Charter Board of Directors meeting held January 2 l-24, 1993 provide an indication of the potential scope of activities of a franchisee, beyond assisting in the provision of services outlined in the agreement letter between the states and HELP Inc. These other activities include:

- Provide administrative assistance in the billing and collection for products and services to the states, while providing HELP Inc. the ability to mark up these products and services as a re-marketer to recover indirect costs incurred by HELP Inc.

- Accomplish Electronic Data Interchange (EDl) translation and services. ED1 refers to a wide range electronic information services in the logistics chain from obtain inputs for manufacturing to the delivery of products to retailers.

- Provide non-ED1 data translation services.[23]

The prospective franchisee was expected to take a comprehensive approach to addressing cost and revenues. The overall approach contained these potential elements:

- Pursue a strategy that minimizes the need for capital investment on the part of both the states and HELP Inc. through some form of volume discount transaction processing schedule by good or service

- Minimum monthly charges or annual fees as relevant

- Per transmission charges and charges for connecting with the Value Added Network run by the American Association of Motor Vehicle Administrators

- Volume discounts for translator software, training, trading partner implementation services, etc.

- Custom products and services available through HELP Inc., to its customers on an extra charge basis.[24]

In summary HELP Inc. is an intermediary that was established to provide three distinct parties a mutually advantageous institutional arrangement. The first group is government agencies. The second is the motor carrier industry, and the third is an entrepreneur, namely Lockheed Corporation, that would serve the first two groups' needs and apply its creativity to produce additional services for a profit.

This institutional arrangement attempts to carefully balance the needs of public and private sectors as well as the interests of the franchisee.

To date the experience of HELP Inc. appears to have been positive, although the exact nature of the final franchise agreement between HELP Inc. and the initiatives Lockheed has been able to undertake under the umbrella of this agreement are unknown.

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23 Briefing document for H.E.L.P. Inc. Charter Board of Directors Meeting., Section J, Procurement Policy, pp. 24-26.

24 Ibid., Section J, Procurement Policy, Help Inc. RFP Draft #l, pp. 24-27.

E. Lessons for ITS

HELP Inc. is an illustration of an intermediary institution set up to serve public and private interests. It came into existence because of the potential significant reductions in costs and administrative burden that might be achieved in both the public and private sector. The ingenuity of Lockheed in identifying and exploiting this opportunity had a great deal to do with its establishment.

Intermediary institutions like HELP Inc. could very well play a powerful role in simultaneously serving the interests of the public and private sectors in deploying ATMS/ATIS. However, prerequisites appear to be a high degree of market exclusivity and being able to generate significant public and private sector cost savings and produce revenues through the sale of products and services. In the case of HELP Inc, a franchise agreement is the contract between the service provider and the intermediary organization, which in turn is under the joint management of the public and private sector. The Board of Directors of HELP Inc., and especially its Executive Committee become the regulatory body for ensuring the franchisee does not use its monopoly power to undue advantage, and to make sure the rates it charges are not unreasonable. It is an unanswered question whether an intermediary like HELP Inc. can be as effective in regulating a monopolist as a Public Utility Commission. Regardless of the answer to this question, HELP Inc. has proved to be a model for expeditious deployment of a certain class of ITS products and services. Regions grappling with the challenges of deploying ATMS/ATIS in a complex multijurisdictional environment requiring intensive public and private involvement might find this approach very attractive.

APPENDIX C - CASE STUDY OF SYSTEM MANAGER APPROACH

One model of ATMS/ATIS deployment is for government to contract with a system manager. The system manager would be delegated authority for implementation of the system within certain parameters, guidelines or specifications. The Utah Department of Transportation has used a system manager for the design, procurement, and installation of an adverse visibility warning system. The process worked extremely well. Sometimes agencies grant too much authority to system managers or do not provide clear enough guidance to avoid future misunderstandings. But these were not problems in Utah's case.[25]

A. Background

The Salt Lake City area lies in a valley surrounded by Mountains and the Great Salt Lake. The area has been experiencing increasing visibility problems due to fog and increased air pollution, especially in the vicinity of the Jordan River. On I-215, a six lane commuter route, there have been a number of large multiple vehicle accidents in recent years. The Utah Department of Transportation (UDOT) sought to implement with federal funding an advanced technological system to provide advanced warning of visibility problems on this section of interstate. The system is called ADVISE which stands for ADverse Visibility Information System Evaluation. The system includes inductive loops detectors, weather and visibility sensors, a central processor, a research terminal housed at the Utah Department of Transportation, radio communications, and variable message signs.

The choice of the procurement strategy was based partly on the need to deploy rapidly. Phase I of the project, which involved implementing equipment to record traffic patterns and weather conditions, was to have been completed prior to the December 1993 winter fog season. Phase II was to involve the implementation of variable message signs and their integration with the overall system. Unfortunately the project fell a year behind and there were a number of problems with equipment procurement. The traffic classifiers selected were not on the state's approved list. There was no approved list for fog sensors. State work forces were not available for loop installation, and it took time to obtain a private contractor. In addition other problems were anticipated, particularly the challenges of systems integration involving detailed electronic, database, and programming issues, the expected length of time to procure additional components, and severe budget limitations resulting from the Federal Highway Administration cutting the funding in half.

B. The Solution and Procurement Process

To address these needs UDOT decided to contract for a systems manager that would be given responsibility for implementation of the ADVISE system as a turnkey project. The contractor would be responsible for system design, programming, installation, training and maintenance. Moreover, it was anticipated that some vendors would be interested in demonstrating or testing new equipment, perhaps as

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25 This case study is based upon the following reference: Sara R. Colosimo and William J Patroliam, "Use of a System Contractor for the design Procurement, and Installation of Adverse Visibility Warning System, Intelligent Transportation: Serving the User Through Deployment, Proceedings of the 1995 Annual Meeting of ITS America, Washington, D.C. March 15-17. 1995, Volume II, 835-844.

a loss leader. The procurement process would follow that normally used for hardware and software acquisition. The procurement was based not on low bid but upon the best suited technology.

Funding for the project was set at a total of $500,000 including $425,000 in federal funds and $75,000 in state funds. The state did not reveal the budgeting level out of fear it would impede negotiation. Rather vendors were given an opportunity to make a Best and Final Offer. If the BAFO was over budget, the state would negotiate with the vendors to either reduce the cost or the state would find additional funds. If no satisfactory agreement could be reached the state would negotiate with the next best vendor.

The procurement process consisted of the issuance of an RFP, a pre-proposal meeting after the release of the RFP, questions and comments from potential bidders, submission of proposals, an evaluation process, and contract negotiations Comments received indicated that the "design-build" process was new for many bidders, but most liked the idea of preparing one proposal, not two for each of the design and build stages. Offerors also liked the opportunity to be heavily involved in deployment from beginning to end. Some more traditional contractors exhibited fear of providing an initial estimate before the BAFO because prices could change significantly and they might be saddled with a loss.

Rockwell International was awarded a design-build, fixed fee contract and negotiations went smoothly except for a demand on the part of FHWA to separate labor and equipment costs, which had been lumped together. Rockwell refused to separate the costs for competitive and proprietary reasons except on the basis of DOD-audited labor rates. The parties eventually agreed to using this method. There was a minor cost increase due to Rockwell's request for additional communication equipment, but this extra cost was covered through the 4 percent cost escalation fee allowed in the contract, and some modest cost cutting elsewhere.

C. Strengths and Weakness of the Process

Overall the system manager approach involving a turnkey implementation was estimated to have saved 10 months time in comparison to the original process. Cost savings from avoiding a separate design contract, certain administrative costs, and the cost of low bid prices for equipment supply, were estimated to sum to $100,000. The design-build fixed fee contract provided incentives for Rockwell to control costs beginning very early in the project. The process also encouraged private vendors to propose additional features and donate equipment and services based upon their pricing strategy. Rockwell donated equipment in return for being able to test it within an integrated system under conditions of bad weather and visibility. Indeed the overall process encouraged creativity on the part of the system manager to provide added features at reduced cost.

UDOT was able to fill in technical gaps with the expertise of system manager. Thus wherever UDOT staff lacked experience or resources, Rockwell was able to fill in. This helps to share costs and distribute risks. For example UDOT was able to specify certain parts of the system and install them where it had experience. Rockwell specified and installed other parts of the system.

A potential weakness of the process is dependence of the contracting agency on the system manager. If the agency does not have the full confidence of the system manager, it can be highly problematic.

Another weakness of a fixed price, design build project, is that if the system manager seriously misjudges the costs, it is liable for the overrun and may cut comers in an unacceptable way.

D. Lessons for ITS

Based upon UDOT's experience, a system manager under a design-build, fixed price contract, has considerable advantages in comparison to traditional low-bid or piecemeal contracting. UDOT was able to document significant time and cost savings. The system manager approach would therefore seem to be a sound option for agencies to consider in procuring ATMS/ATIS systems. UDOT's experience indicates that tightly specified RFP's work well, but the system contractor needs to be given substantial flexibility to apply its creativity to cost reduction and providing added features and services, whether these result in equipment capabilities, enhanced integration, or extra services and products.

The design-build approach encourages internalization of all project costs that might otherwise be divided up into projects associated with different implementation stages. Lifecycle costs are likely to be significantly reduced and some of these savings are likely to be passed onto procuring agency.

The difficulties in combining consultant design services, and procurement should not be minimized however, and the procuring agency needs to proceed cautiously. All parties need to cooperate and be fully informed every step of the way. The state needs to assume the initial role of the contractor at the outset to in order to establish the project parameters, guidelines and specifications. The RFP may be very detailed where it is possible to develop specifications knowledgeably. However, by providing broad specifications, respondents can apply their creativity to satisfying them. Where the procurement agency lacks the knowledge, offerers should be allowed to specify what is needed, including innovative and specialty technologies, which may be offered at reduced cost. Some kind of budgetary guidance in the RFP can also help offerors submit a proposal that is within budget limitations.

APPENDIX D - CASE STUDY OF THE DULLES TOLL ROAD EXTENSION

The 14 miles extension to the Dulles Toll Road, now known as the Dulles Greenway, is an example. of a privately funded toll road project designed to satisfy important transportation needs of the general public west of the Washington Dulles International Airport. A private firm was able to obtain the financing for the project largely because projected toll revenues were sufficient to cover costs of development and operation and earn a profit.

A. Background

When the Washington Dulles International Airport opened for business in 1962, a four lane highway known as the Dulles Airport Access Road also opened. The access road serves only traffic to and from the airport. It was built within enough surrounding right-of-way to accommodate additional service roads. In 1980 the Virginia Department of Transportation asked the Federal Aviation Administration, which had funded the access road, to permit construction of a toll road that would provide access for non-airport traffic traveling between Fairfax County and Washington D.C., including local trips.[26] VDOT had never conceived this road as being anything but a toll road. The main reason is capital investment requirements for highway improvements in northern Virginia and throughout the state were enormous, and VDOT saw a need to find additional sources of funds, including toll collection, to meet highway needs. The Dulles toll road was an obvious candidate.

Through the sale of bonds, $57 million was raised, construction began, and a 12 mile, four-lane Dulles Toll Road opened to traffic in October 1984. Before the end of 1985 traffic levels had nearly reached the design capacity of 47,300 vehicles and the Virginia DOT recommended that it be widened from four to six lanes. VDOT began the planning process including alignment and environmental studies and holding informational meetings.[27]

VDOT did not originally expect to extend the toll Road into Loudoun County, but rapid growth west of the airport stimulated interest among local officials regarding the need for additional highways there. It was not long before proposals for a private and public toll roads surfaced.

A privately funded project to extend the toll road was conceived by John Miller of the Municipal Development Corporation (MDC) and Bill Allen of Parsons-Brinckerhoff in 1986. They recognized that toll revenue might be sufficient to design, build and operate such a facility under a privately financed turnkey project. At the time, the Governor of Virginia, Gerald L. Bailes had made transportation a top priority of during his first year of office and appointed a bi-partisan Commission to address transportation needs for the twenty-first century, first concentrating on highway needs and then other modes of transportation.[28]

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26 Virginia Department of Transportation, "Dulles Greenway Milestones.

27 Ibid.

28 Gomez-Ibanez, Jose A. John R. Meyer and Marcella Butler, Private Toll Roads in the United States, The Early Experience of Virginia and California, Final Report prepared for the

Almost simultaneously, Miller tested the possibility of a private toll road extension of the Dulles Toll Road with a number of legislators. After some negotiations between Loudoun County officials, where the toll road extension would be built, and top VDOT officials, the legislature approved the "Virginia Highway Corporation Act of 1988, which permitted a private corporation to build, own and operate a toll road for profit. Under the Act, the State Corporation Commission was required to determine that any application to develop a private toll road was in the public interest, and the Commonwealth Transportation Board was required to approve the location, design and costs of the project.[29]

Soon after the toll road legislation was enacted, Ralph Stanley, former Administrator of the Urban Mass Transit Administration under the Reagan Administration, joined MDC. Stanley was a staunch advocate of privatization. It turned out that MDC was in financial trouble, having over-extended itself on other projects, and for all practical purposes backed out of the extension project when MDC ran out of funds in summer of 1988.[30]

To resurrect the toll road extension project, Stanley together with another former MDC director decided to form the Toll Road Corporation of Virginia (TRCV), and as a result of an initial stock offering raised $3.63 million in capital to develop the project. The project was originally conceived as a sale-leaseback arrangement. Upon construction, the road would be sold to property owners (airport and private property owners) from whom the right-of-way would be originally leased. The road would then be leased back at payments equivalent to 30 year debt with the prevailing interest rate at the time.[31]

The project progressed but with fits and starts. A major challenge was to convince the officials and residents of Loudoun County, the Commonwealth Transportation Board, and the State Corporation Commission that the extension should be developed as private toll road. By this time VDOT had begun advocating extending the original toll road as a publicly funded project. Competing alignments and designs for a publicly and privately financed toll roads were developed by VDOT and the TRCV. Public hearings were held and VDOT passed out a 19 page information brochure comparing the two approaches. According to the handout, the private toll road would be built and opened quicker with lower private than public project costs ($184.7 million versus $127.6 million) and lower private than public financing costs ($146.6 million versus $240 million). However, the tolls charged to road users for the publicly owned toll road would be a flat $1.50 over the life of the project, whereas the charges for the privately owned toll road would rise from $1.50 at the outset to $3.25 by the year 2010. The total undiscounted costs to state residents for the public toll road was estimated at $399.4 million for the public toll road and $732.1 million for the private toll. The discounted cost comparison also showed the public facility to be less costly to state residents than the private one.[32]

U.S. Department of Transportation, Harvard University, December 1991., pp. 24-25.

29 Ibid.,pp. 27-3 1.

30 Ibid., pp. 32-34.

31 Ibid., p. 33 and p. 46.

32 Ibid. pp.36-39.

TRCV countered this analysis with one prepared by Price Waterhouse which tried to put the two projects on an equal footing. Price Waterhouse argued that VDOT erroneously subtracted from the costs of the toll road extension the surplus left over from the original toll road. Instead, Price Waterhouse argued that the analysis should take into account the imputed costs for the debt on the original. construction costs. After making adjustments in interest rates, Price Waterhouse argued that VDOT would have to charge $3.60 to $3.88 per vehicle to cover the project's lifecycle costs.[33]

These costs comparisons mattered little in the end. The decision to go the private route was mainly due to TRCV's effective lobbying and the lack of trust local officials and residents in northern Virginia had in VDOT.[34]

Shortly after the Corps of Engineers issued the environmental permit for the project in spring of 1991, TRCV abandoned its sale-leaseback approach in favor of a two-staged limited partnership arrangement. The trials and tribulations of the Savings and Loan Industry upset the original financing assumptions, and forced TRCV into a different financial structure. The first partnership called TRIP I, which included the TRCV, would build the toll road extension. TRIP II would buy the completed extension from TRIP I, and TRCV would dissolve, with its equity investors continuing as partners in TRIP II. To be able to pursue this partnership approach, the legislation authorizing private toll roads needed to be amended to allow partnerships for this purpose. The amendment passed the Virginia legislature.[35]

Permanent financing for the project was arranged by C.C. Pace Resources which had extensive project development experience in electric power, transportation, natural gas, fuel acquisition and project finance.

Revenues derived from tolls, a function of traffic volumes, were projected to grow 8 percent per year, and were the financial justification for the project. The final financing package for the project totalling $326 million was as follows:

- A group of ten institutional lenders, led by SIGNA Investment Incorporated, Prudential Power Funding Associates (a unit of the Prudential Life Insurance Company of America) and John Hancock Mutual Life Insurance Company made a commitment to provide $258 million of long term fixed rate notes due 2022 and 2026 to finance construction and operation.

- Barclay's Bank, the Nation's Bank, and Deutsche Bank provided a part of the construction financing and $40 million in revolving credit.

- Average maturity of the notes was 30 years which were rated BBB by Fitch Investors Service.

- A first mortgage and security interest in all the developer's rights, title, and interest in the toll road extension secured the finance.

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33 Ibid. p.40.

34 Ibid. pp.38-5 1.

35 Ibid. pp.60-65.

- There was an average lifetime return on equity of 21 percent.[36]

It was possible to secure the loan in this way because all of the right-of-way acquired through lease, purchase or donation by landowners who were convinced they would benefit from development of the toll road extension. The Washington Metropolitan Airport Authority leased about one third of the roadway. Another third was donated by landowners as a part of rezoning their lands, and the final third was purchased. No condemnation was necessary.[37]

The developers also took an aggressive approach to compliance with all environmental permits and bent over backwards to make sure the project was as environmentally benign as possible. Another key feature of the project was the proposed use of state-of-art Automatic Vehicle Identification and electronic toll collection.

Earlier in November 1988, the Commonwealth Transportation Board had approved the location of the toll road extension from Route 28 to Leesburg after completion of the design. Subsequently the Board approved the application to construct and operate the toll road extension, and the State Corporation Commission issued a certificate of Authority to the TRCV for a 42.5 year franchise to build and operate it. Groundbreaking for construction of the 14 mile toll road extension occurred on September 29, 1993.[38]

B. Lessons for ITS

Private development of the Dulles Greenway depended upon a highly predictable revenue stream derived from toll revenues and the ability the developer to obtain use of the rights of way through donation, purchase and lease. Without this stable revenue stream and a basis for securing the loan, financing could not have been raised. Similar conditions will be required if ATMS/ATIS were to be privately financed. Indeed, the feasibility of privately financing ATMS/ATIS would be a near certainty if the private sector were permitted to develop a sufficient number of private toll roads that would be an integral part of a regional transportation network and provided important funding and data for an ATMS/ATIS.

Of course, the public sector could just as easily impose toll collection facilities on existing highways and generate toll revenues that could be used in part to implement ATMS/ATIS.

Whether publicly or privately financed, there would be considerable public and political resistance to widespread deployment of toll facilities, not to mention the fact that imposing tolls on interstate freeways is likely require the federal government to be paid back its share of the original interstate construction costs. Some of the resistance will be due to those who favor transit over highway

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36 Ibid. p. 45. Also see Dulles Greenway, TRIP II, "Financial Facts About the Dulles Greenway."

37 Charles E. Williams, " Road for Today, A Vision for the Future," Construction Business Review, March/April 1994, pp. 66-69.

38 Virginia Department of Transportation, "Dulles Greenway Milestones."

improvements and would advocate that a portion of toll revenues should be shared with the public sector, especially transit operators.

Development of the toll road extension also required a careful balancing of public and private. needs and concerns. In this case the State Commonwealth Corporation of Virginia, the equivalent of a Public Utility Commission, was entrusted with issuing a Certificate of Authority to develop the project, and the Commonwealth Transportation Board had to approve the location, design, and construction costs. If ATMS/ATIS were deployed under an arrangement where the developer had exclusive development rights as well as the ability to extract monopoly prices from the public, the developer would also have to be regulated in one form or another.

The most striking feature of this case study is the enormous complexity of the institutional and financing elements, and the persistence required to bring the project to fruition. Non-traditional and creative ways to finance ATMS/ATIS, including private finance, will require equal vision and perseverance. There is no assurance, as in the case of the toll road extension project, that those who commence such a project will reap the rewards and not suffer financial losses. Others may pick up the ball when the project appears to be doomed and become the winners instead.

APPENDIX E - CASE STUDY OF FLORIDA HIGH SPEED RAIL

Efforts to develop high speed rail in the State of Florida provide useful lessons concerning privately financed transportation investments predicated upon franchising and real estate value-capture techniques. Florida, along with California and Texas, was among the first states to thoroughly explore the feasibility of implementing high speed rail through franchising.

A. Background

In the early 1980's Florida like many other states, realized that it would be highly desirable to strengthen and diversify its passenger transportation system which was oriented to auto and air travel. In 1982, Governor Bob Graham issued an executive order that established a blue ribbon committee charged with planning a high speed rail system for Florida. In 1983 the committee issued a feasibility study that said it would make sense to build a high speed rail system in Florida. Moreover, with innovative financing and incentives, only private financing would be needed.[39]

The Florida legislature passed the Florida High Speed Rail Commission Act in 1984. This act sought to establish a public/private partnership to foster the development of high speed rail. The Act called for the establishment of a seven-member Commission within the Florida Department of Transportation to pursue the deployment of a high speed rail system.[40]

B. Financing and the Franchise

Thus the State of Florida commenced a highly creative and aggressive effort to apply advanced technology to radically improving rail passenger service and to augment its existing transportation network. The Florida High Speed Rail Act recognized the enormous capital investment required and included numerous provisions designed to attract investors. The primary incentives were the prospect of having an exclusive franchise to develop and operate the system, to use real estate value-capture techniques as a means of financing the system, and the issuance of tax exempt bonds on behalf of the private developer.

The Act authorized the franchisee to use joint development, benefit assessment districts, tax increment financing, and the award of development rights in order to develop the rail system. Investors competing for the franchise could incorporate any or all of these techniques into their proposals. The Act also enabled the franchisee to acquire property through condemnation by using the state's power of eminent domain. The legislation assumed that the high speed rail system would be deployed within existing highway and rail corridors to minimize environmental impacts and land acquisition costs.

The act also authorized the state to issue tax exempt bonds on behalf of whomever was awarded the franchise. However, the private sector franchisee must secure the bonds using its revenues or its own

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39 Florida Department of Transportation, "Florida High Speed Rail Program, November 12, 1992.

40 Ibid.

assets. Bonds could not be secured by public funds derived from the taxing authority of the state or local jurisdictions.[41]

C. Two Proposals

As a result of these inducements, in 1988 two consortia were attracted to the prospect of being awarded a franchise to design, construct, and operate a high speed rail system that connected Miami, Orlando and the Tampa Bay region and submitted plans for review. The first was the Florida High Speed Rail Corporation which proposed to employ Swedish high speed rail technology and to base the financing entirely on real estate development revenues. The second was the TGV Company of Florida which proposed to use the French TGV high speed trains but required public funding to get started.

An intensive review process commenced upon submittal of these plans. In 1989 the TGV Company of Florida withdrew its application because it continued to be convinced that real-estate value capture techniques would be insufficient to finance the project and the state could not meet this company's requirement of supplementary public funding. In July 1991, the Florida High Speed Rail Corporation also withdrew its proposal because it too could not finance its plan.[42] Within three years estimates of projects costs tripled ann revenues and ridership fell in half resulting in both investor and public enthusiasm evaporating.

D. Modifications to the High Speed Rail Program

As a result of this failure, the Florida legislature completely re-examined the high speed rail program, and concluded that pure private financing and deployment of the entire system at once was unrealistic. Consequently in June 1991 the legislature abolished the Florida High Speed Rail Transportation Commission and transferred all responsibilities for high speed and magnetic levitation programs (maglev) to the Florida Department of Transportation and consolidated them with commuter rail and intercity (Amtrak) planning and programming. By this time the Florida legislature had passed the Magnetic Levitation Demonstration Project Act in support of a maglev demonstration project that would connect the Orlando International Airport with tourist attractions near Walt Disney World.

Florida DOT and the legislature then significantly revamped the high speed rail program. In March 1992 the Florida legislature passed the High Speed Transportation Act that reopened and streamlined the franchise and certification process. It permitted the implementation of the high speed rail system in segments. Development could focus first on those segments that generate the most riders and benefits. Existing tracks and service were to be upgraded, as appropriate to allow Amtrak and commuter rail high speed rail service. Public funding could be used for initial construction and upgrading. Also, DOT was encouraged to conduct ridership, market and environmental studies to support right-of-way acquisition, alignment determination and engineering. Additional objectives included securing federal funding and

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41 Ibid.

42 Ibid.

43 Robert S. Cox, "Maglev, Getting it Off the Ground," The Military Engineer, No. 553, p. 35.

legislation to support Florida's efforts, preserving the private sector role and value-capture as a means of financing, and establishing a long term dedicated source of revenue for the rail improvement program.[44]

E. California and Texas

It is interesting that initial efforts of California and Texas were no more successful than Florida's to establish a franchising process for the deployment of high speed rail. The consortia involved in those cases could not obtain the financing either.

F. Lessons for ITS

Both the public and private sector need to carefully scrutinize proposals that key portions of ATMS/ATIS can be entirely privately financed. Notwithstanding highly creative approaches to financing, including real estate value capture techniques and allowing private firms to benefit from lower interest rates of publicly issued debt, it is quite likely that some elements of ATMS/ATIS will need partial or complete public financing, or are not viable from a either private or public standpoint.

A major lesson from the Florida high speed rail experience is that incremental deployment may be far more feasible than deployment of an entire advanced technological system, whether through private or public financing, or a combination of both.

Some specific lessons regarding the franchising process that are relevant to Florida, Texas, and California experience in high speed rail are the following:

- In Florida a special commission, with adequate staff and funding was established to oversee deployment of high speed rail. However, in Texas and California, agencies were required to fund their operations from developer deposit fees. Once these fees were gone, staff may not be able to administer the program or negotiate effectively with the developers.

- Policy determinations should be made early in the franchise process. The early development of a draft franchise agreement can help illuminate the key issues and facilitate successful negotiations of key or contentious points.

- Employ a fast moving process, set deadlines, and stick to them. Deadlines for obtaining financial commitments are the most important. The ability of potential franchisees to meet these deadlines is usually decisive regarding whether the project can move forward.

- The process of awarding a franchise should occur within an open process that allows for input by all interested and affected parties. This helps to reduce the risks of lengthy protests and litigation.

- Avoid imposing public interest obligations on the developer if they are secondary to the proposal. Complex advanced technological systems within multijurisdiction environments have fragile economics. Projects that depend upon profitability should not be weighed down with

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44 Florida Department of Transportation, "Florida High Speed Rail Program," November 12, 1992.

baggage that can undermine the project,[45] as long as compelling public interests are not sacrificed.

45 Larry S. Gallegos and Don J. Dempsey, "Franchise Agreement Development Issues for Proposed High Speed Train Projects," presented at the APTA 1991 Rapid Transit Conference, June 12, 1991.